CIRCULATES IN EVERY PROVINCE IN CANADA.

CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper devoted to the manufacturing interests, covering in a practical manner the mechanical, power, foundry and allied fields. Published by the MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg and London, Eng.

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POSTAGE PAID TORONTO

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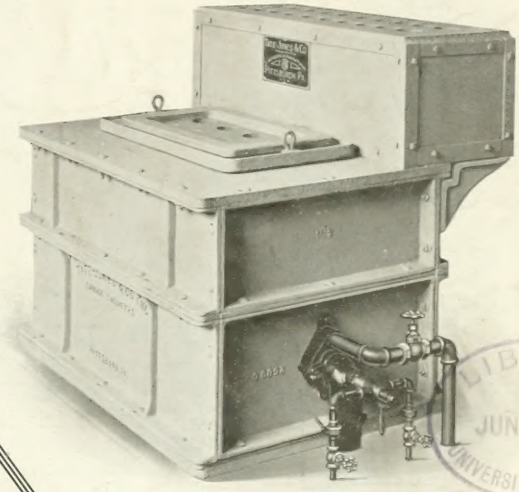
FOR

HEAT-TREATING

SHRAPNEL

or Nosing in Lead Baths

Use a



Pre-Heater Lead Pot Furnace equipped with Combination Gas and Oil Burner.

This furnace eliminates the sudden change of temperature from plunging cold shells into the molten bath, gives large output and considerably reduces fuel consumption per shell.

Shells are pre-heated in the upper chamber before being plunged into the lead bath, thus saving otherwise wasted heat and giving more satisfactory and uniform results.

There is a "Tate-Jones" furnace particularly designed for every operation necessary to enable you to satisfactorily meet the specifications for Heat Treating, Nosing or Annealing of the Shrapnel, Lyddite or cartridge cases that you are manufacturing.

We will gladly send particulars.

Tate-Jones & Co., Inc.

PITTSBURGH, PA.

TATE-JONES

PRE-HEATER

LEAD POT FURNACE

CAPACITY

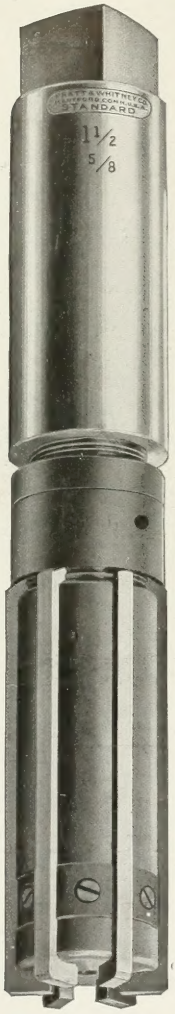
Pre-Heater 20 Shells.

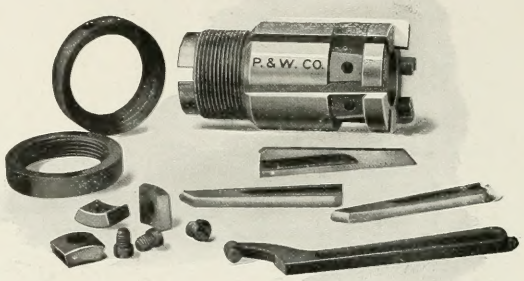
Pot 8 Shells at one time.

YOUR REAMERS

Can You Keep Them Up to Size?

Make sure that all your reamed holes are smooth and accurate





Parts of P. & W. Solid Adjustable Blade Reamers

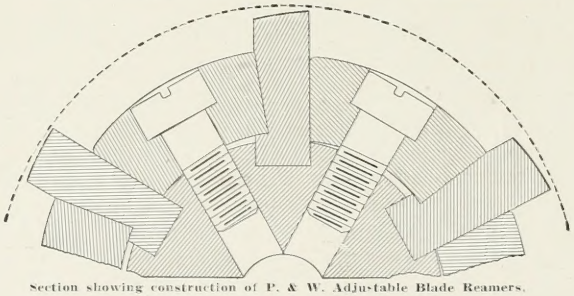
Use P. & W. Solid Adjustable Blade Reamers

Unexcelled for Design, Simplicity and Ease of Adjustment

1. The eccentrically relieved blades are stronger than others, do not chatter and produce a smoother hole.
2. The hand, shell and fluted chucking reamers have interchangeable nuts, screws and wrenches.
3. The bottom of a hole can readily be faced.
4. By a simple adjustment of the blades the reamer can easily be set to size without regrinding.

Reduce Your Reaming Costs

Write for catalog, "Small Tools," showing our complete line.



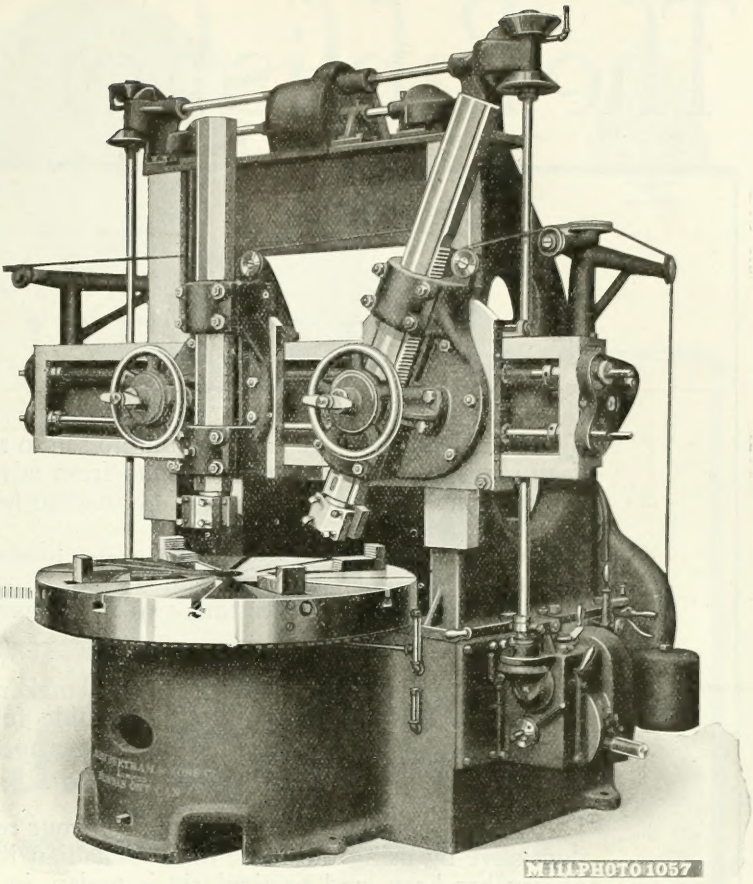
Section showing construction of P. & W. Adjustable Blade Reamers.

Pratt & Whitney Company of Canada, Limited

DUNDAS	MONTREAL	WINNIPEG	VANCOUVER
Ontario	723 Drummond Bldg.	Bank of Hamilton Bldg.	B.C. Equipment Co.

The advertiser would like to know where you saw his advertisement—tell him.

Bertram Boring & Turning Mills



NILES TYPE

42-inch Vertical Boring and Turning Mill

MOTOR DRIVEN THROUGH SPEED BOX
BUILT IN SIZES FROM 42-INCH TO 100-INCH SWING

Drop us a line for photographs and full particulars.

The John Bertram & Sons Co., Limited

Dundas, Ontario, Canada

MONTREAL
723 Drummond Bldg.

VANCOUVER
609 Bank of Ottawa Building

WINNIPEG
1205 McArthur Bldg.

The Publisher's Page

By B.G.N.

RESULTS!

¶ Advertisers who have had anything to sell to shell manufacturers have had wonderful results from advertising in recent issues and shell numbers of "Canadian Machinery."

¶ We have many letters from advertisers telling us of these results. One tool steel firm, for instance, opened new accounts with as many as forty-two of Canada's largest manufacturers.

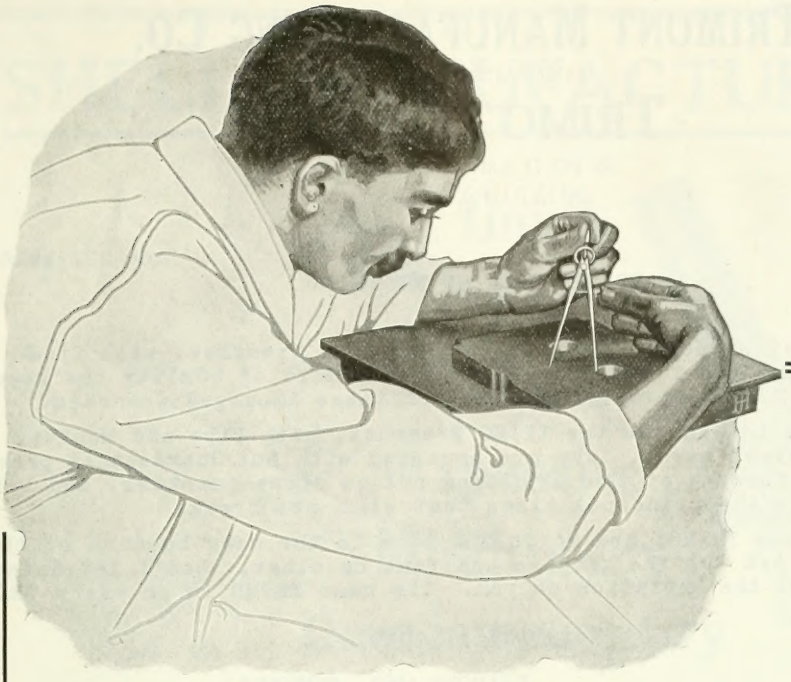
¶ Letters we have received prove that shell makers are using "Canadian Machinery" as a buying guide for securing their equipment. Are you one of those who are taking advantage of this opportunity?

¶ If you are a shell maker, why not keep your regular product alive by using the force that "Canadian Machinery" always has been, and particularly is to-day, in the metal-working shops of Canada? If you are not a shell maker, you should be equally interested in more thoroughly establishing your name and product as against the time when competition will be keen.

¶ "Opportunity" knocks but seldom. Interest and attention make advertising opportunity. Surely the time to start is now. Think it over.

Rate cards and full information will be sent on application.

CANADIAN MACHINERY
143 UNIVERSITY AVE. TORONTO, ONTARIO



Starrett Dividers

Strength and Balance

Starrett dividers are made in a number of styles and sizes—each style designed to suit some particular class of work. Strength, stiffness and balance are features of Starrett dividers which make them superior. The strength and stiffness insure accuracy and long service, while their perfect balance permits more rapid work with greater pleasure to the mechanic.

Toolmakers' Dividers

The dividers shown here are round leg toolmakers' dividers for very fine work. Sizes and prices as follows: 2"—$1.00, 3"—$1.25, 4"—$1.50, 5"—$1.50, 6"—$1.75.

Before buying fine tools, write for a free copy of the Starrett 320-page No. 203, which describes 2100 styles and sizes of fine tools and hack saws.

The L. S. Starrett Co., Athol, Mass.

World's Greatest Toolmakers

New York London Chicago

42-454

Starrett Tools

The Standard Instruments of Precision

TRIMONT MANUFACTURING CO.

MANUFACTURERS OF

TRIMO TOOLS

55 TO 71 AMORY STREET
ROXBURY, MASS.

June 22, 1915

TO THE USER OF WRENCHES

Gentlemen:-

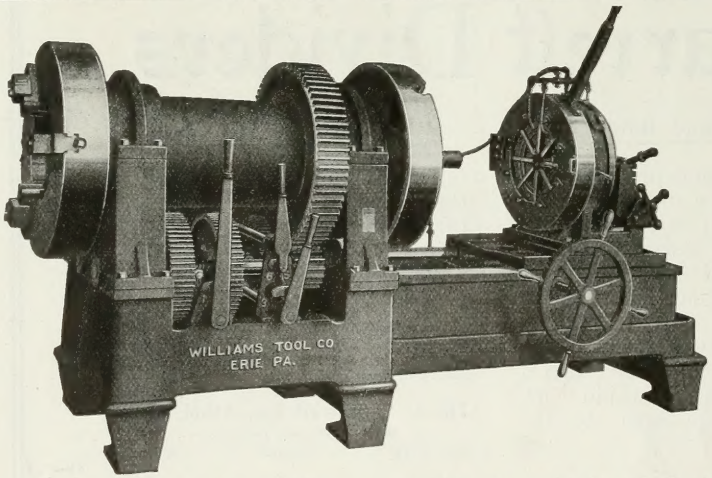
Users of Wrenches, both Pipe and Monkey wrenches, will find economy in buying the TRIMO makes. A new standard of quality has been set by Trimont Mfg. Company, the makers of these improved wrenches.

Be sure to ask for the TRIMO Wrenches, both Pipe and Monkey, which are all-steel goods. They are equipped with Nut Guards that prevent the accidental turning of the adjusting nut in close quarters, and with Steel Frames, in the principal sizes that will not break.

These new TRIMOS are worth 25% more to the user because of these improvements. Ask for the genuine and take no other. Don't let unfair dealers pass out the imitation on you. The name TRIMO is on every TRIMO tool.

Very truly yours,

TRIMONT MFG. COMPANY



The gas light was a big improvement over the tallow dip, but it had to give way to the electric light; and the Tungsten has superseded the little glimmer that once delighted us.

If you are still employing pipe-cutting methods as antiquated as the tallow dip, you need a Williams Pipe Machine, which occupies the same position in the pipe-cutting field as the Tungsten does in the lighting world, to bring you up-to-date.

Let us quote you prices and terms: any machine to cut 10 sizes of pipe between 1-4 inch and 18 inch, with any kind of power.

Anyone making, selling or buying a pipe machine, claimed to be a Canadian-made Williams Pipe Machine, does so without right or authority from us, and is liable to prosecution for damages.

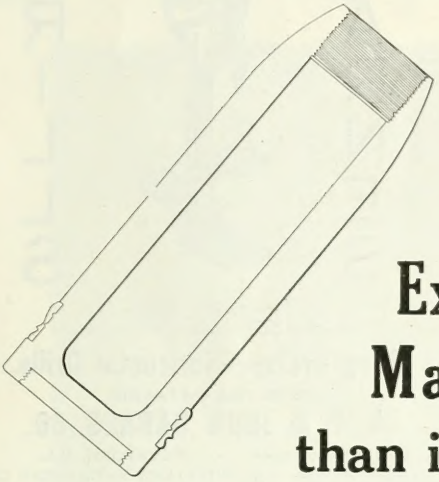
Williams Tool Co., Erie, Pa., U.S.A.

AGENTS:

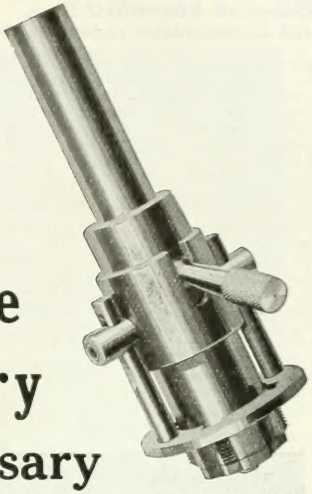
A. R. WILLIAMS MACHINERY COMPANY

ST. JOHN, N.B. TORONTO WINNIPEG VANCOUVER

SHELL MANUFACTURERS



Don't Buy More Expensive Machinery than is necessary



We can offer positive proof that the majority of Canadian and American Shell Makers are using MURCHEY COLLAPSING TAPS on 4.5 and 18 lb. High Explosive Shell and Automatic Opening Dies for Plugs. These tools are the least expensive equipment for this work. **We guarantee results** will be satisfactory. You take no chances. Then **why** buy equipment costing five to ten times more?

ALSO—Collapsing Taps will handle tapping operations **faster** than any other method.

Use the BEST, CHEAPEST and FASTEST equipment, and save money, time and worry.

MURCHEY MACHINE & TOOL COMPANY

34 Porter St., Detroit, Michigan

Our Newly Designed

Shrapnel Shell Cleaning Machine

Cleans all *Standard* Sizes and accommodates various *other* sizes

The table of this machine has six shell pockets. Three of these are in the Blasting Department, and the other three, as shown in the illustration, are in the open. Thus, while three of the shells are being cleaned, the operator can remove the other three that have been cleaned, replacing them with three more to be blasted.

Consequently the machine can be kept in constant operation.

This machine, if connected to any exhaust system, will be nearly dustless and absolutely automatic in operation.

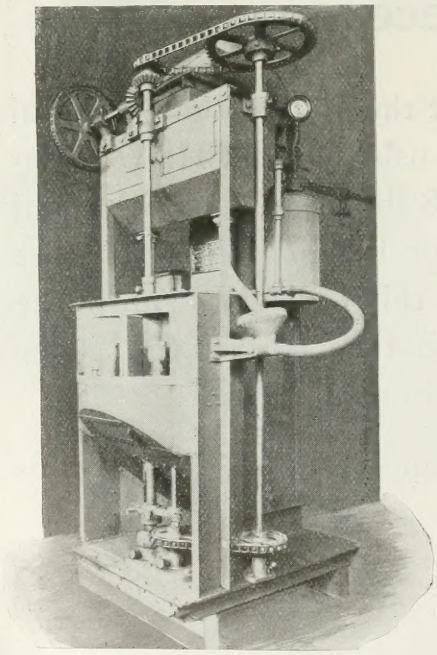
On the sand blasting table proper the division plates are lined with wood. This protects the steel plate. The wood is inexpensive and easily replaced.

The machine is so designed that the copper band groove is blasted on the exterior of the shell and another nozzle blasts the upper part of the exterior of the shell.

Its capacity for continuous running is from 150 to 200 shells per hour.

We are anxious to tell you all about it.

Write us.



We are manufacturers of Sand Blast equipment for any particular need. Also cleaning mills, dust arresters, cinder mills, resin grinders and other foundry equipment.

The W. W. SLY MANUFACTURING COMPANY

CLEVELAND OHIO

The

BARNES DRILLS

Complete line. 8-inch to 50-inch swing

Gang Drills.—Horizontal Drills.

SEND FOR CATALOG.

W. F. & JOHN BARNES CO.

104 Ruby Street - ROCKFORD, ILL.

Canadian Agents—A. R. WILLIAMS MACHINERY CO Toronto, Winnipeg, Vancouver, and St. John, N.B.

WILLIAMS & WILSON, Montreal

Steel for Shells!

PROMPT SHIPMENT

Billets and rounds of suitable physical and chemical specification for forging and turning into shrapnel cases and lyddite shells of any size.

LACKAWANNA STEEL COMPANY

Standard structural shapes,
Standard heavy and light rails,
Sheared and universal mill plates,
Sheet bars, and Lackawanna
Steel sheet piling.

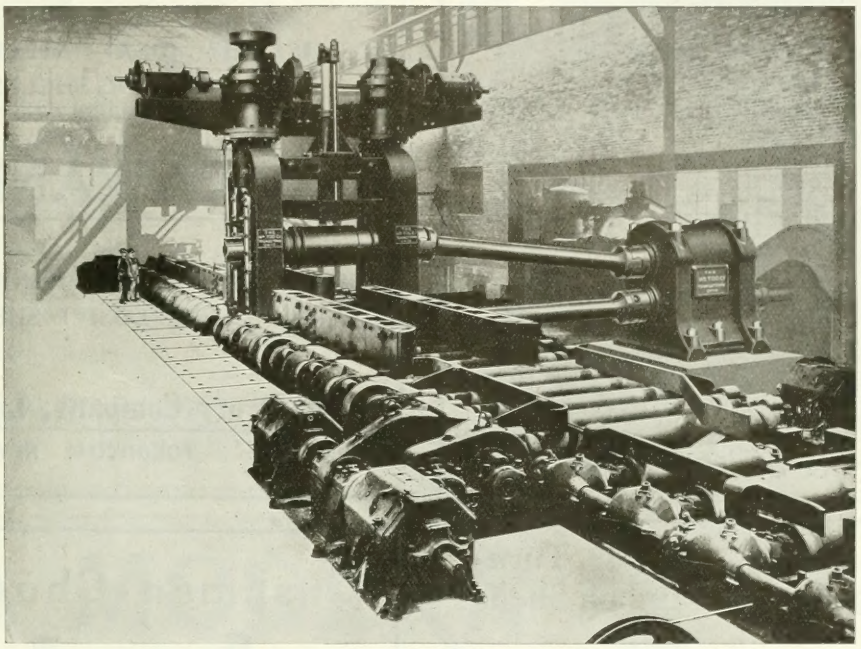
General Sales Offices: LACKAWANNA, ERIE CO., N.Y.

Canadian Correspondents:

H. A. DRURY & CO., LTD., 309 Craig St. W., MONTREAL

The advertiser would like to know where you saw his advertisement—tell him.

Rolling Mill Machinery



Tod Blooming Mills represent engine builders' standard of design and workmanship.

Tod patented spindles eliminate shock, are easily dismantled, and save a large percentage of power used in ordinary mills.

Accurately machined double helical gears in a patented housing reduce upkeep and result in high efficiency.

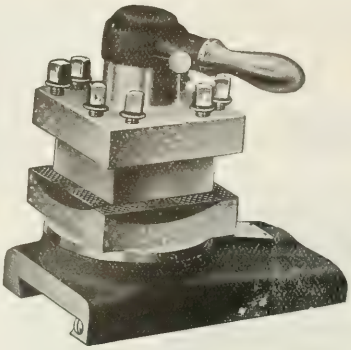
The William Tod Co.

YOUNGSTOWN, OHIO

ROLLING MILLS

ENGINES—Rolling Mill, Gas Blowing, Pumping.

CONDENSERS, SPECIAL MACHINERY



Particularly Adapted to the Manufacture of Shrapnel

Your Lathe Needs A NEW TOOL POST. One of the Modern Multiple Type.

You can no longer afford to use the old style single tool holder.

Give us the size of the dovetail on your lathe carriage and height to lathe center; we will quote you price on a Modern Tool Holder that we guarantee will increase your production, and give you some interesting facts about Lathe Turrets.

No matter what make or size of lathe—we can fit it.

Fay & Scott, Dexter, Me.

SABEN EXTRA HIGH SPEED STEEL

IS THE IDEAL STEEL FOR MACHINING SHELLS

LACKAWANNA

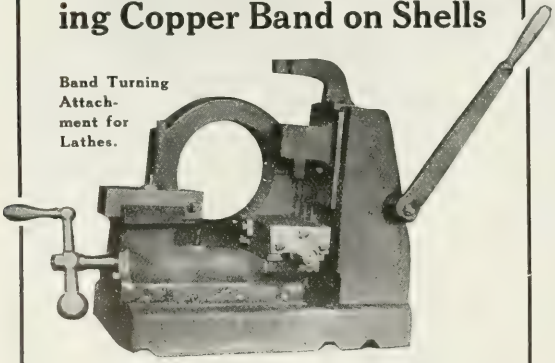
STEEL BARS FOR SHRAPNEL AND HIGH EXPLOSIVE SHELLS

H. A. Drury Company, Limited

MONTREAL TORONTO NEW YORK

A Time-Saver for Turning Copper Band on Shells

Band Turning Attachment for Lathes.



This attachment will fit any engine lathe, and with its use you can turn the copper band on Shrapnel Shells down to size required and burnish them *all in one operation.*

With this device we will guarantee an output of

50 Turned Copper Bands per Hour

Used with a specially constructed steel chuck, casting of which can be finished on the lathe on which the attachment will be used.

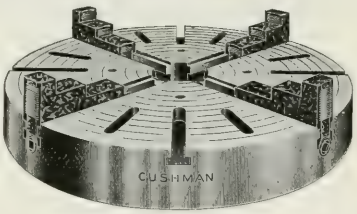
Castings are supplied by us.

WRITE FOR PARTICULARS.

LYMBURNER LIMITED

5-15 Commissioners St. Montreal, P. Que.

Cushman Chucks



When you buy a "Cushman" Chuck you are absolutely sure of getting one having strength, accuracy and durability. Being specialists in these goods we are able to furnish Chucks of quality at a very moderate price.

Our line of styles and sizes is very complete—

Lathe Chucks, Drill Chucks, Centering Chucks, Portable Face Plate Jaws

Our regular chucks are known as the heavy pattern, but we now have a new line called "Blue Line" Chucks, made entirely of steel.

Let us send you our catalog.

The Cushman Chuck Co.

Hartford, Conn., U.S.A.

The advertiser would like to know where you saw his advertisement—tell him.

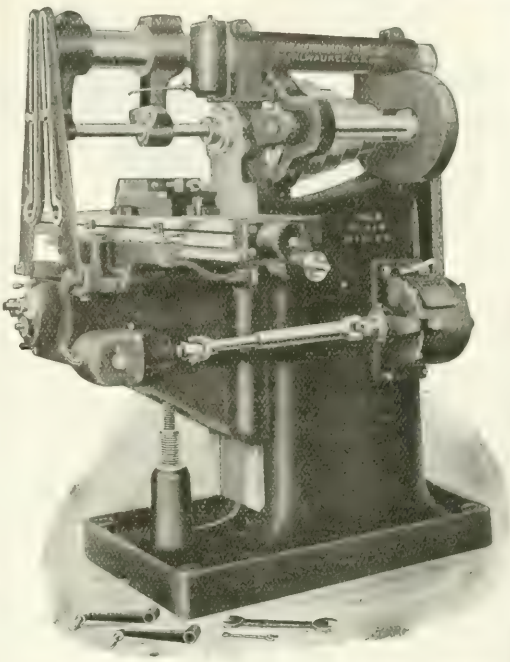
KEMPSMITH
PLAIN MILLERS

Built in Four Sizes Knee Type
Two Sizes Lincoln Type

These milling machines are characterized by simplicity of operation, rigidity of design and highest accuracy in construction.

Our literature on the construction and use of Milling Machines will be found interesting and suggestive. Sent gladly on request.

KEMPSMITH MFG. COMPANY
MILWAUKEE, WIS.



A MODERN SAVER
of Time, Money, Space and Labor

Here is a machine that is well worthy of your attention—our **"Double C Punch and Shear"** with 48-inch throat.

This machine has an enormous capacity for doing **rapid, accurate** and **economical** work of **quality**.

Let us send full description. If you are interested in up-to-date money-saving machinery you cannot afford to remain uninformed.

We manufacture a complete line of

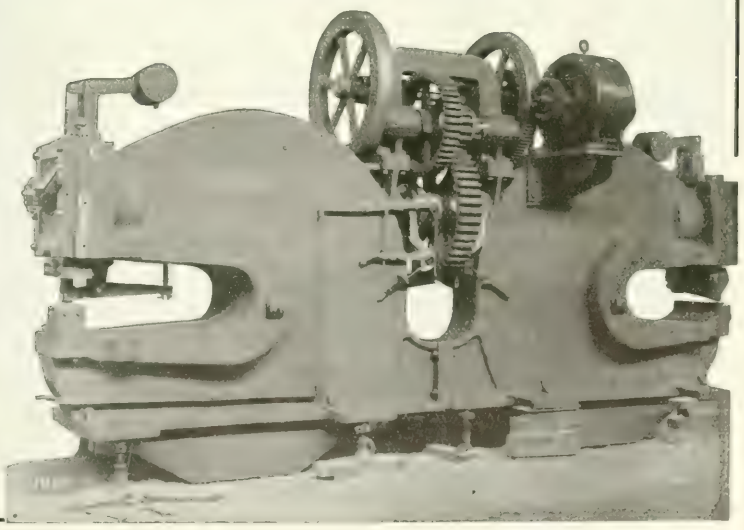
LABOR-SAVING MACHINERY

all kinds and sizes, for

Structural Iron Works, Railroad and Locomotive Shops, Boiler Shops, Rolling Mills, Agricultural Implement and Plow Shops, etc.

The Long & Allstatter Co.
HAMILTON, OHIO

Canadian Representatives
RUDEL-BELNAP CO.
Montreal, P.Q. Toronto, Ont.



Make One Barrel Do What Two Barrels Did Before

THE minute you install one Globe Tumbling Barrel you can pension two of your old-fashioned horizontal barrels and still do a wider variety of work —and do it a great deal better and many times faster.

GLOBE TUMBLING BARRELS

save time because they don't have to be stopped for filling, emptying or inspecting of the work. They save floor space, because they stand vertically and occupy little room—and they save money, because they require a smaller investment in barrels.

Eight stock sizes, $50 to $170. Our Booklet 2 contains useful information on tumbling — shows the different styles of Globe Barrels and tells what each will do. Write for a free copy to-day.

The Globe Machine & Stamping Co.
Cleveland, Ohio, U. S. A.

This COUPON → will bring you our **NEW BOOKLET** which will demonstrate to you the **unlimited Ways of Using an**

L'AIR LIQUIDE SOCIETY
Maisonneuve—Montreal, P. Q.

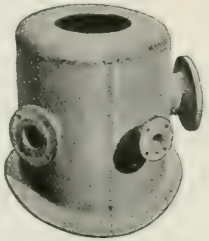
Send, without obligating me, postpaid, your NEW BOOKLET, which I promise to read.

NAME.....
ADDRESS.....
Province..... Date.....
Business ..... C.M

OXY-ACETYLENE WELDING and CUTTING PLANT

which should be found EVERYWHERE, where METALS are handled. —INDISPENSABLE for MANUFACTURING and REPAIR Purposes.

"MADE-IN-CANADA" GOODS



Welded Collector, with Flanges also Welded on.

L'AIR LIQUIDE SOCIETY

(Paid-up Capital $2,200,000.00)

26 Boler St. WEST TORONTO — Maisonneuve— MONTREAL — 325 William Ave. WINNIPEG

EVERYTHING in the OXY-ACETYLENE LINE

CLEVELAND SAND RAMMERS

FOR FLOOR, BENCH, PEIN AND FLASK RAMMING

Cleveland Sand Rammers are made in several sizes and weights, and are adapted for all kinds of Ramming in general foundry service.

The Piston Rods are packed with a resilient packing that conforms to the shape of Rod without retarding its free action, and prevents any dirt from entering piston chamber and working parts — Rammers are fitted with either Round or Flat Rods as required. Cleveland Rammers are light in weight, have high speed and practically no vibration, making them ideal foundry tools.

CLEVELAND CHIPPING HAMMERS

For General Foundry Work. Are furnished in any required size or weight for grey iron or steel castings; they have high speed, and are particularly adapted for fast chipping now required by piece-work operators.

BOWES AIR HOSE COUPLINGS

Over 1,000,000 in General Use

Bowes Couplings are instantly connected or disconnected.

Bowes Couplings are absolutely air tight under all pressures.

Above cut shows the Never-Slip Clamp attached to Bowes Coupling.

In Stock:—RIVETING HAMMERS, DRILLS, REAMING, TAPPING AND FLUE-ROLLING MACHINES, CORNER DRILLS, PORTABLE AND BENCH GRINDERS, ETC.
Catalog No. 12 mailed on request.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

80 DUCHESS STREET, TORONTO, ONT.

Agents: A. R. WILLIAMS MACHINERY CO., TORONTO — WILLIAMS & WILSON, MONTREAL

Sand Rammer in operation.

The advertiser would like to know where you saw his advertisement—tell him.

OXY-BLAUGAS
Welding and Cutting Plants

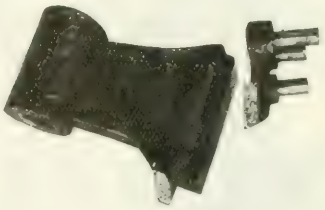
are noted for their Safety, Ease of Transportation, Low Cost and High Efficiency

BLAUGAS is the safest industrial gas.
BLAUGAS has more heat value than any other gas.
BLAUGAS has very narrow explosive range.
BLAUGAS does not freeze.
BLAUGAS is ready to use—no generation.

Oxy-Blaugas Plants do not require an expert to operate.

Why not jot down a line now for full particulars on this money-saving and profit-building proposition? You have everything to gain and nothing to lose.

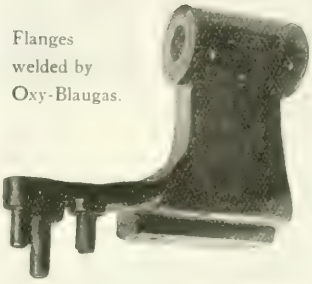
Canadian Blaugas Co., Limited
263 St. James St., Montreal, P. Q.



Flanges broken entirely off.

One of the OXY-BLAUGAS Jobs

Flanges welded by Oxy-Blaugas.



STEEL CASTINGS
WE MANUFACTURE
Adamantine, Chrome, Manganese and Nickel Steel Castings
ANNEALED AND UNANNEALED
NONE TOO LARGE FOR US TO HANDLE
MACHINE MOULDED GEARS
Any size up to 18 feet in diameter,
without the use of patterns
Hull Iron & Steel Foundries
LIMITED
Head Office and Works at HULL, P. Que.
Branch Office at Montreal, P. Que.
TRADE MARK

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

U. S. Electric Drills and Grinders

Save Time, Labor and Money

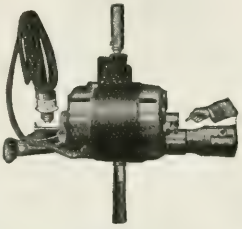
They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

3 SIZES.
3-16 inch, W.G.T. 6 lbs.
¼ inch, W.G.T. 9 lbs.
⅜ inch, W.G.T. 12 lbs.

All motors wound for 110 or 220 volts. Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



½ inch—2 SPEED.
Speed, 400-750 R.P.M.

For Sale By
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver.

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

Portable Emery Grinder

Take the Tool to the Work and Save Heavy Handling

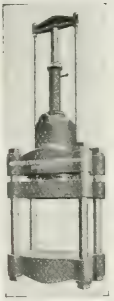
We are inventors of the
Flexible Shaft
For all Purposes.

The oldest and largest manufacturers in the world.

CAN FURNISH MOTOR DRIVEN WHEN DESIRED

Write Us for Catalogue and Prices.

STOW MFG. CO. BINGHAMTON NEW YORK
Established 1875
Oldest Portable Tool Manufacturers in America.
General European Agents—Selson Engineering Co., Ltd.
85 Queen Victoria St., LONDON, ENG.



ELMES HYDRAULIC PRESSES

Especially adapted for and largely used in the manufacture of **Projectiles, Shrapnel Cases and General Forging Work.**

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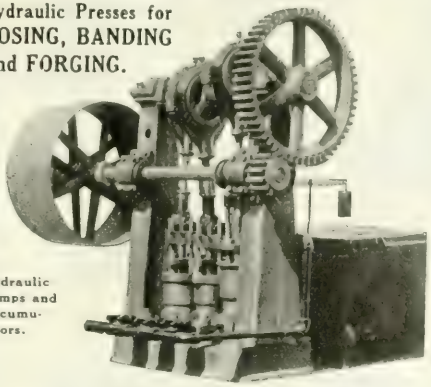

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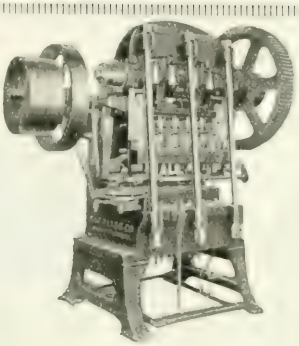

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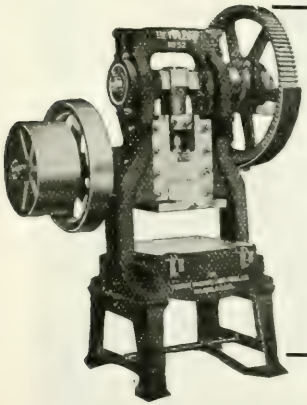

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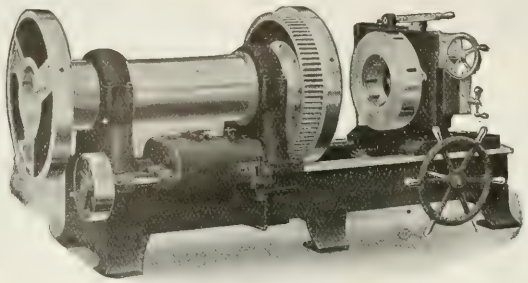

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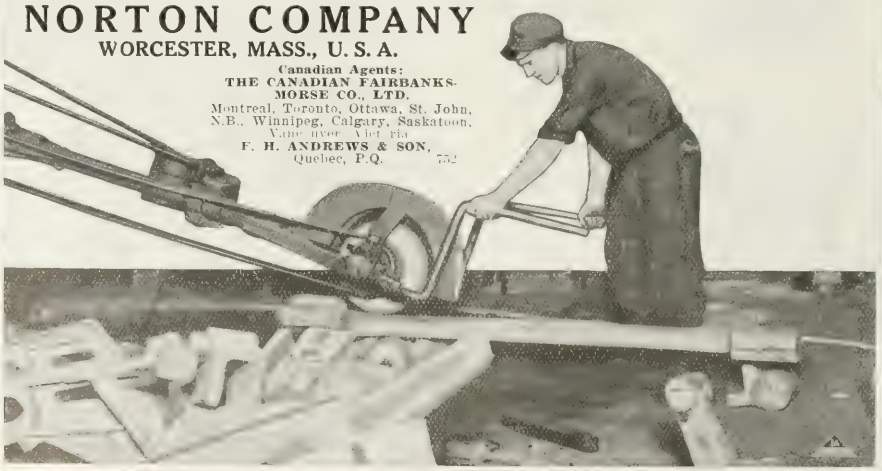

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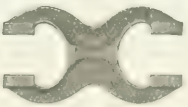

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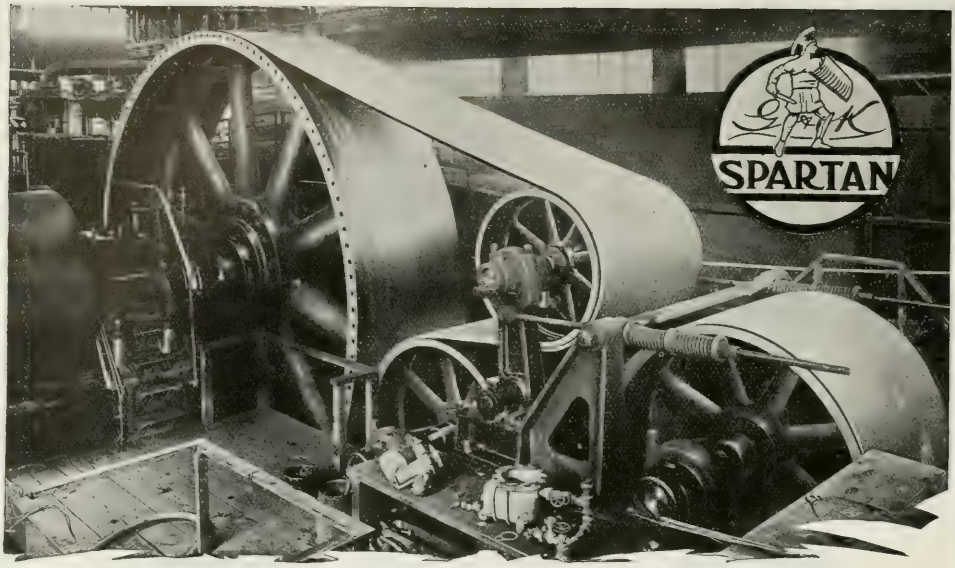

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Shrapnel Shell Manufacture

Shell Department of a General Engineering Works

Staff Article

Perhaps the most fortunate of the various manufacturing establishments in its ability to readily take over the shell business is the general engineering plant. The equipment usually requires comparatively slight alteration, and there are also at hand the type of men and scope for designing and building any necessary special apparatus at short notice.

MORE 18 pounder shrapnel shells have been made in Canada, than have any other size and denomination since the industry was started here some ten months ago, and every shop has its own system worked out and has tooled up in manner that will best utilize the equipment installed. Thus, upon entering this particular plant which carried on a general engineering business previous to the outbreak of the war and the inauguration of the industry of shell making, we are confronted with some extremely interesting tooling. The present shell shop was originally that known as the compressor shop. It is a new and up-to-date building standing somewhat apart from other and older buildings.

Primary Operations.

The shells are received in the main machine shop where they have their open ends marked off roughly to length with scratch awl gauges. They are then chucked in a "Bertram" engine lathe, carrying a universal chuck, and the open end is cut off to rough length with a parting tool. The shells are next carried over to the shell shop, the first operation there being to face the bases roughly. This is done on a vertical boring mill manufactured by H. Bickford & Co., Lakeport, N.H. To the table is bolted a jig which is capable of having twenty-four shells clamped to it. The machine is shown in Fig. 1. Both heads are utilized so as to divide the working strains over the machine more evenly. The machine is motor-driven by a 10 h.p. General Electric Co. motor. Four tools in all are used, two being attached to each head.

Rough-Turning.

The shells next pass on to the rough turning operations. Two "Bullard" vertical boring mills are used for this. The boring mills are each fitted with a turret on which the various tools are carried, and both machines are motor driven. Fig. 2 shows one of the boring mills tooled up for the work. This machine is to all intents and purposes a vertical turret lathe. On the table is fitted an expanding chuck, the details of which are given in Fig. 3. The shell is chucked on this arbor. A fixture corresponding to the cross slide on a lathe carries several of the tools in a revolving tool holder.

A tool carried on the cross slide and ground with a wide cutting edge faces the base of the shell. A rough-turning tool, projecting from the same side of the tool holder as the facing tool is next brought up to the work and a rough taper is formed on the end of the shell to allow the rollers on the box tool following immediately to take up the work. This box tool is carried on the turret, and rough turns the shell down to a distance of 1¾ inches from the end. The following rollers prevent the shell from springing away from the tool to any extent.

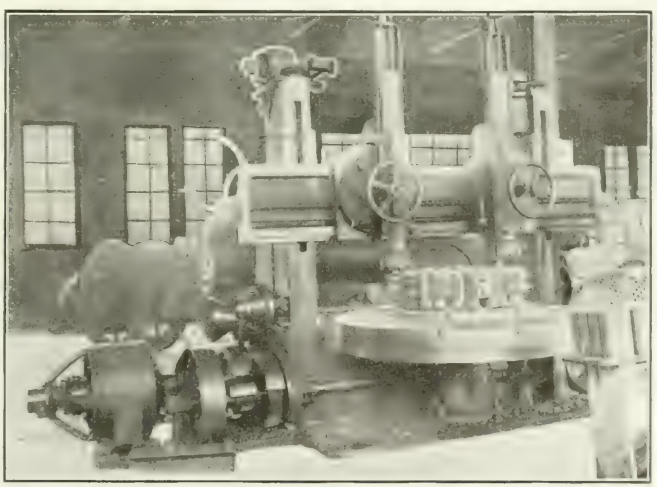


FIG. 1.—FACING BACK END OF SHELLS ON A H. BICKFORD & CO. VERTICAL BORING MILL.

For the next operation the turret is swung, and another box tool of similar design is brought into the work. This tool is carried on the turret and finish turns the shell up as far as the driving band recess.

The next operation is to form the radius on the base of the shell and to rough turn and form the driving band groove. These tools are carried on the cross slide. The shell is, however, supported by rollers from the turret during this operation. The last tool in this operation is a rough taper forming tool

carried on the cross slide. It turns the rough taper on the open end preparatory to nosing. A "Gisholt" turret lathe is also tooled up to accomplish these operations. No lubricant is used on the vertical boring mills, but, on the "Gisholt" turret lathe, a soda water compound is employed.

Boring.

The boring of the shells is accomplished on two "Jones & Lamson" flat turret lathes. These are equipped with "D. E. Whitton" self-centering chucks. There are two boring bars from the turret, one carrying the roughing cutters and the other carrying the finish cutters. The latter are placed in the bars inclined a little to the horizontal —about an angle of 10 degs. to 12 degs. After these two operations are accomplished, the turret is swung again and the unfinished portion of the shell is rough turned and the nose faced. This constitutes the series of operations on the turret lathes fitted up for the boring operations. Fig. 4 shows one of the turret lathes fitted up for the boring, while Fig. 5 shows the gauges used to test the shell after boring. These gauges test the thickness of metal in the base, the distance between the bottom of the powder pocket and the diaphragm seat, and also the profile of the powder pocket and the diaphragm seat.

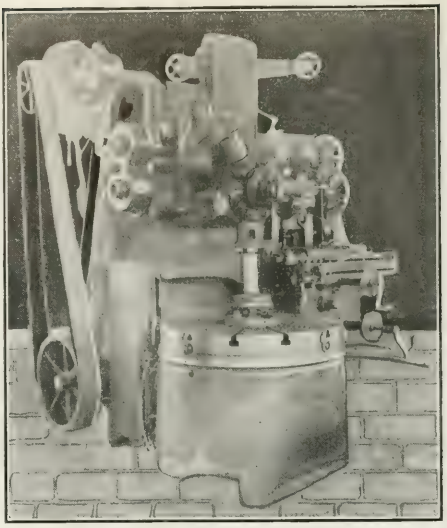


FIG. 2. "BULLARD" VERTICAL BORING MILL TOOLED UP FOR ROUGH TURNING SHELLS.

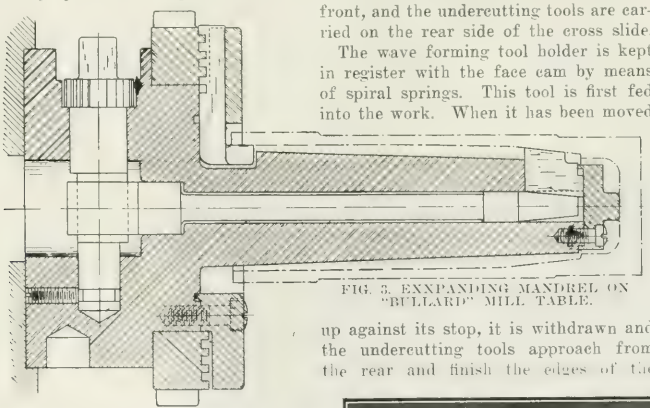


FIG. 3. EXPANDING MANDREL ON "BULLARD" MILL TABLE.

Machining the Driving Band Recess.

Two engine lathes are tooled up to accomplish this work. One is a motor driven "C. M. C." engine lathe and the other is a "Bertram" engine lathe. Fig. 6 shows the "C. M. C." lathe. A split box chuck is attached to the face plate. The shell is chucked up against a stop A split bush is placed on the shell and the chuck closes down on this bush. On the face plate is bolted a three-point face cam, which is integral with the split chuck. The wave forming tool is carried on the cross slide of the lathe at the front, and the undercutting tools are carried on the rear side of the cross slide.

The wave forming tool holder is kept in register with the face cam by means of spiral springs. This tool is first fed into the work. When it has been moved up against its stop, it is withdrawn and the undercutting tools approach from the rear and finish the edges of the groove. These tools are fitted to small tool holders, which travel in slides at an angle to the work. In this manner the undercutting is accomplished. With the completion of this operation the groove is finished. The "Bertram" lathe is tooled up in an exactly similar manner.

Heat Treatment.

The shells are next taken to the heat-treating department. Small oil furnaces, capable of taking in seven shells at a time, are installed. The shells are heated to 1,600 degs. F., and kept at that temperature for twenty-five minutes. A small furnace, accommodating only four shells, is also used. A "Hoskins" pyrometer is employed to keep tab on the temperatures of each furnace, and can be connected to any of the furnaces in the department. Upon being removed from the hardening furnaces, the shells are placed in a large vertical cylindrical tank of seal oil, being held in a woven wire basket and lowered into the tank. The oil, of course, absorbs a great deal of heat from the shells, and in order to keep it cooled to those temperatures at which the best results are obtained, cold water coils are placed in the bottom of the tank. To further cool the oil, jets of compressed air are also requisitioned.

The shells are removed and the surplus oil is allowed to drain from them. They are then tumbled in sawdust to remove any oil that may still remain. Following this they go to the oil burning annealing furnaces where they are kept at a temperature of 500 degs. F., for ten minutes. Upon being removed from the annealing furnaces their noses are heated to about 1,400 degs. F., in a lead pot; two shells at a time being thus heated.

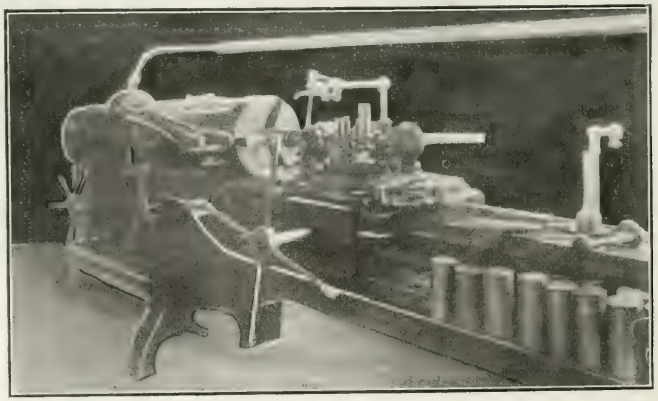


FIG. 4. JONES & LAMSON FLAT TURRET LATHE TOOLED UP FOR BORING SHELLS.

They are placed on a wrought iron shelf which is submerged in the molten lead.

The shells are nosed on a motor driven rivet press to which suitable dies have been fitted. Two strokes of the punch perform the operation. After being

"Bertram" lathe equipped with a special forming cam. The cross feed has been disconnected, and weights suspended from wire cables attached to the cross slide keep it in register with the forming cam. This operation is also accomplished

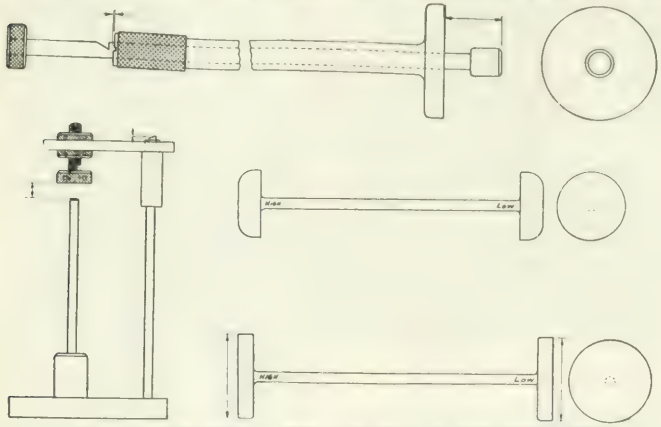


FIG. 5. GAUGES USED IN THE MACHINING OF SHRAPNEL SHELLS.

closed in, the noses are again heated to a dull red and placed in trays of powdered lime. This latter process tends to anneal the noses and remove all traces of chill due to the hot metal striking the cold nosing.

Finishing Inside of Nose.

The shells are taken back to the shell shop from the heat treating room and there the inside of the nose is machined. Three lathes are tooled up for this work. One is a London Machine Tool Co. product, the second a "Bertram" lathe, and the third a motor driven Canada Machinery Corporation lathe. The tooling on all three lathes is similar, turrets being fitted to the cross slides of the lathes. Fig. 7 shows the London Machine Tool Co., lathe fitted up with the turret on the carriage to do this work. A split chuck is screwed to the live spindle of the machine and is carried in an outer bearing. The shells are chucked against a stop. Fig. 8 gives a layout of the tools carried on the turret.

The first operation is to bore the nose, the second is to rough face it, and the third to finish face it. The nose is then tapped with a collapsible tap. Finally, the inside turning and forming tool is fed into the work. Suitable stops are fitted to all three lathes, which stops control the operations of the various tools.

Finish Turning and Grinding.

The finishing operations are done on a "Landis" grinder, but previous to the grinding operation the shells are turned and formed to within fifteen or twenty thousandths of finished size. The turning operations are accomplished on a

ed on a Fitchburg Machine Co. "Lo-Swing" lathe, the taper attachment being modified so as to take care of the special form. The third lathe on this work is a "Bertram" engine lathe but no forming cam is attached to it, being simply used to turn the straight portion of the body.

A plug centre is screwed in the nose of the shell to enable it to be put in the lathes, the centre being on an extended

shank upon which two flat sides have been ground. A driving dog is placed on the shank so that the shells are placed with their noses towards the lathe headstocks. The other end of the shell is carried in a revolving centre. On the Landis grinder a large stone dressed to the profile of the shell finishes the body and the nose at one operation. The grinder is a heavy one, being a 20 in. x 120 in. machine. A special plug centre is screwed in the nose of the shell and acts as a driver, while the other end of the shell is supported in a revolving centre. The wheel is frequently dressed to insure the production of accurate bodies and noses, and excellent production results have been obtained.

Two Canada Machinery Corporation lathes are fitted up for finish turning the shells, both being equipped with forming cams and having their cross feeds disconnected. The first lathe is driven by a motor manufactured by the Reliance Electric & Engineering Co., of Cleveland, Ohio. The face plates have been removed and the fixture shown in Fig. 10 substituted. A dog on the base end of the shell engages with the driver A and drives the shell. A plug centre in the nose of the shell is supported by the tail stock spindle. The second lathe has a universal chuck which is used to grip the base and drive the shell. This lathe in other respects is similar to the other.

The shells are next sandblasted and

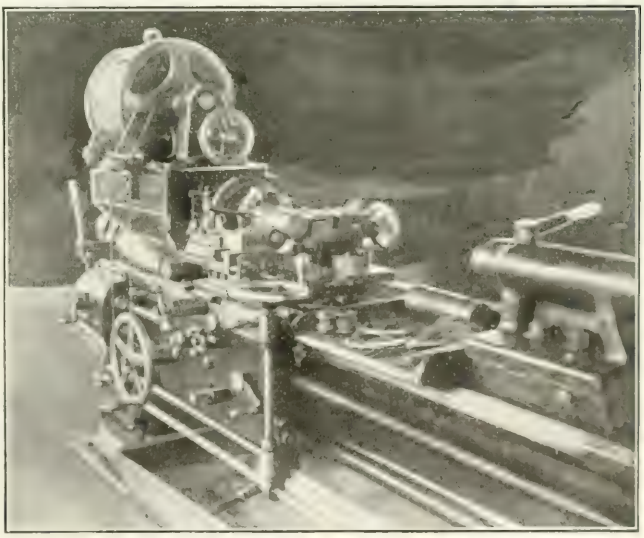


FIG. 9. CANADA MACHINERY CORPORATION MOTOR DRIVEN ENGINE LATHE TOOLED UP TO TURN THE COPPER DRIVING BAND RECESS.

cleaned up, particularly so in the recess grooves and bases. They then pass on to the preliminary Government inspection.

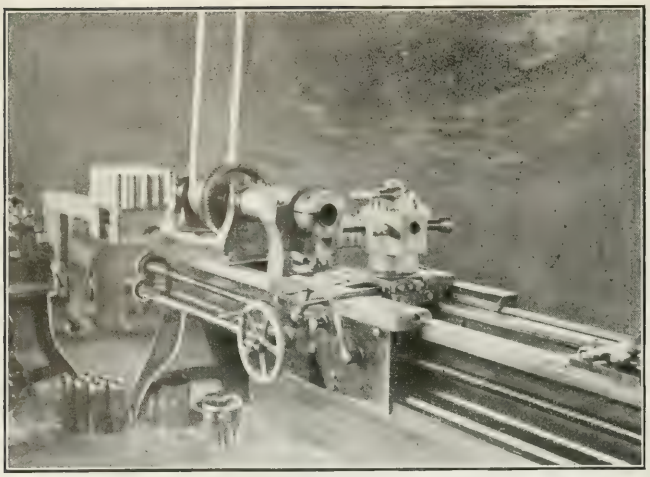


FIG. 7. LONDON MACHINE TOOL CO. ENGINE LATHE FITTED WITH SPECIAL TURRET ON CARRIAGE FOR MACHINING INSIDE OF NOSE.

Pressing on and Turning the Copper Bands.

The next operation is to press on the copper bands, this being accomplished on the pneumatic machine shown in Fig. 11. This machine was built at the works and is very efficient, being operated successfully on an air pressure of 40 pounds.

After the band has been pressed on the shell, it goes to the band turning lathe shown in Fig. 12. This lathe is fitted with a universal chuck, and the shell moves in against a stop. The roughing tool is carried on the cross slide and moves up against a stop. The finishing tool is carried on the rear of the lathe, and this tool comes down and shaves the band to size.

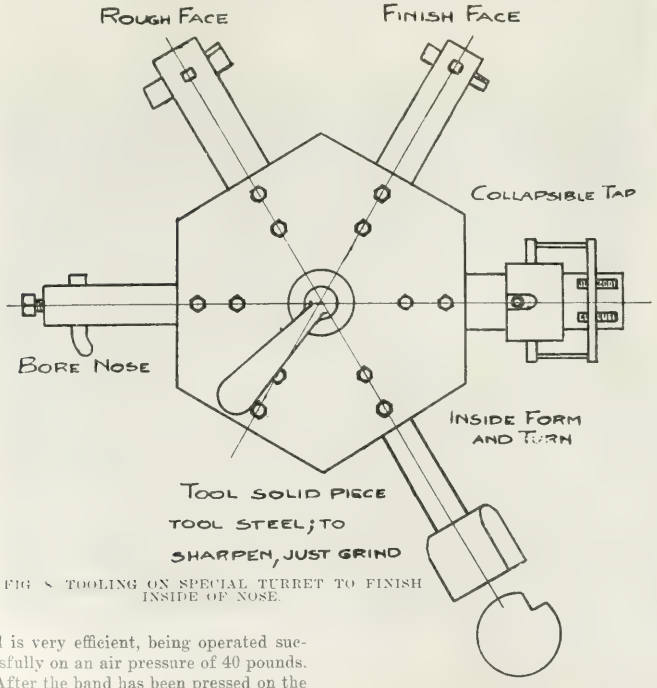


FIG. 8. TOOLING ON SPECIAL TURRET TO FINISH INSIDE OF NOSE.

Assembling.

The shells now pass on to the assembling department. Here the powder cups and brass powder tubes are inserted. Running in of the shot follows. Next the molten resin is poured in, after which the shell is weighed carefully. The brass sockets are then screwed home, the thread being first coated with red lead. Next the powder tube is soldered to the socket and the shell passes on to the socket finishing lathes.

Finishing Brass Sockets.

The brass sockets are finished on an Acme Machine Tool Co. turret lathe. The base of the shell is carried in a two-jaw chuck, and the outer end is carried in a steady head as can be clearly seen in Fig. 13. The turning and forming tools which are carried on the cross slide, approach from the front and move up against a stop. The little tool which

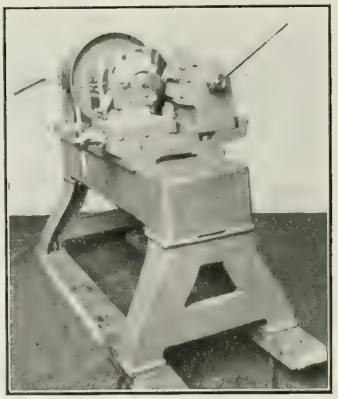


FIG. 12. JENCKES MACHINE CO. BAND TURNING LATHE.

turns down the end of the nose approaches from the rear. A spot facing tool is carried on the turret; this cleans up the projecting end of the powder tube, the central shank going into the latter. A second tool on the turret faces the bottom of the socket. This completes the socket machining operations.

Final Shop Inspection.

The shells now pass to the final shop inspection, where the sockets are tapped

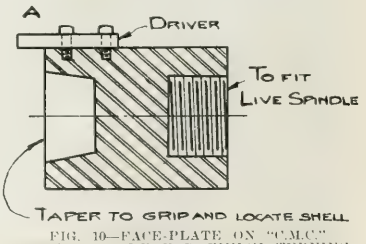


FIG. 10—FACE-PLATE ON "C.M.C." ENGINE LATHE FOR FINISH TURNING

out, the grub screw hole tapped and also the powder tube reamed. Com-

pressed air is used to blow out dirt from the powder tube. The shells next pass to the Government inspectors who pass upon them finally.

day. Excellent natural and artificial lighting is provided, and the shop is thoroughly modern and up-to-date in every respect.

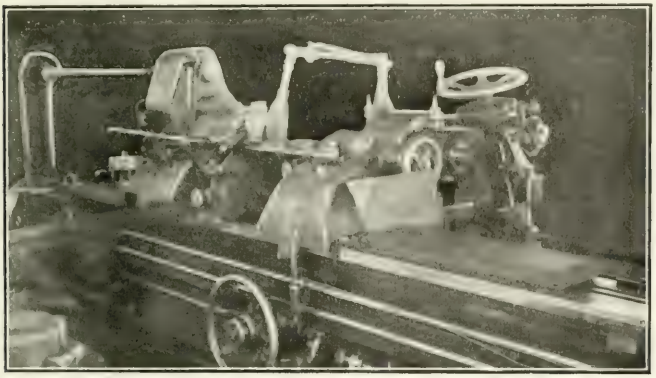


FIG. 9. "LANDIS" GRINDER FITTED UP TO GRIND THE BODY AND NOSE OF THE SHELL AT SAME TIME

Painting.

After the shells have passed the Government inspection the little brass plugs are screwed into the socket. Small lathes are fitted up to hold the shell and revolve it for painting. The nose of the shell is supported by a square centre which fits into the brass plug and does the driving. The base is carried in a revolving centre. A priming coat of black japan is given the shells, after which they are placed on shelves to dry. Later they are replaced in the painting lathes and a finish coat of paint is applied. At the same time the noses are coated with red lead. When dry, the shells are packed in boxes of six and shipped.

General.

The shop is operated on a piece-work basis, and two shifts of men are employed. The shell output it is expected will soon reach five hundred shells per

the tremendous price to which spelter has soared must be giving our War Department very grave concern. Continuing, the writer says: "I find that on July 31st, 1914, spelter was quoted in the region of $115 per ton and copper round $300 per ton. These prices have now advanced to around $550 for spelter and $465 for copper. In the manufacture of cartridge and shell-case metal, spelter of 99.9 per cent. purity is used, which costs about $100 per ton more than the above prices, and is exceedingly scarce at that figure.

"I have had 15 years' practical experience of metal manufacturing and hot and cold rolling, and I really do not see why the present very expensive cartridge and shell-case metal should not be displaced by hot-rolled tough copper accurately finished by the ordinary cold-rolling process. The finished cartridge and case can be drawn just as easily from copper as from the present expensive metal, and can be made much

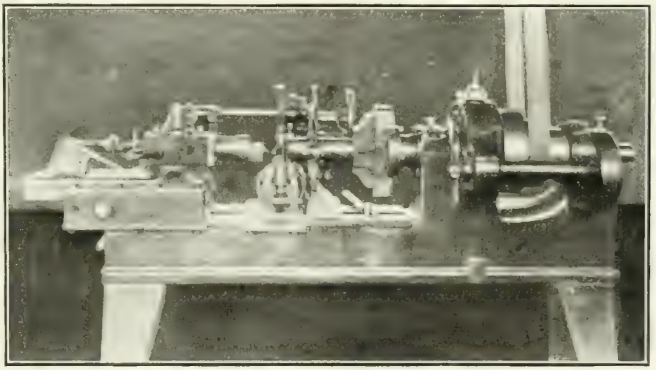


FIG. 13. TURNING BRASS SOCKETS ON AN ACME MACHINE TOOL CO. TURRET LATHE.

CARTRIDGE CASE METAL.

IN a communication to the "Manchester Guardian," a correspondent says that more rapidly and by more manufacturers. There are a large number of hot-rolling mills at present manufacturing copper sheet and strip whose extensive plant could be utilized.

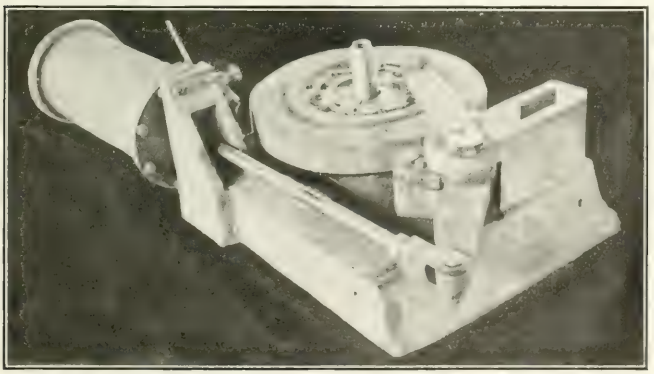


FIG. 11 JENCKES MACHINE CO. BANDING PRESS

To Deaden the Sound of War.—According to a correspondent, an interesting invention which has just been adopted by the Admiralty is known as the Mallock—Armstrong ear defender. The earpiece is no larger than the cotton wool plugs hitherto used, but contains a diaphragm of goldbeater's skin, which, while readily responsive to ordinary volumes of sound, muffles any abnormal sound. This effect is brought about by a "stop" which limits the distance through which the diaphragm can vibrate. While the ear receives readily and clearly a word of command, it is protected from the noise of the discharge of a gun.

Fire Control in Relation to Military Rifle Practice*

By Major A. C. Geddes

The last few years have witnessed a revolution in the musketry training of the British Army. A new series of ideas has been evolved and put into practice, so far as could be done in times of peace, and the new method is now undergoing its first war test. This paper gives a brief description of the work of the School of Musketry at Hythe, at which place the new ideas were worked out, and incidentally upsets our accepted ideas of rifle shooting.

THE work done during the retreat of the British Army from Mons proved conclusively that there was very little wrong with their rifle shooting, for no comparatively small force could have so fallen back in face of superior numbers if the men had not been masters of their weapon.

There is a general idea that rifle shooting is very simple; all that is necessary being to adjust the rear sight upon the weapon to suit the distance of a well-defined target, to allow for any wind that may be blowing, to aim leisurely, and to pull the trigger. This is the theory which is practised at Bisley, and those who follow it are clamoring to have it continued in its old form. The fact that this form of rifle shooting is almost useless for active service does not seem to make any difference to them.

A departure from this simple idea of firing a rifle to hit a mark must be made as soon as rapid shooting begins under service conditions, and as a result certain complications arise. For instance, it has been found by experiment that with the British rifle and Mark VI. ammunition, there is a deviation of the line of departure of the bullet from the line of the axis of the barrel, caused by the motion set up in the latter by the force of the explosion. This deviation, which is known as "jump," depends upon the nature of the charge, the muzzle velocity of the bullet, the condition of the rifle, including the bore of the barrel, the tightness of the screws holding the barrel to the stock, and whether there is a bayonet fixed or not, and with every variation in the manner in which the rifle is held.

Long Range Mark Shooting.

Therefore, on active service, the simple theory of rifle shooting is no longer true. Conditions then prevail when the rifle cannot be kept always at the same temperature, or fired so slowly that the barrel does not heat. All this at once throws doubt upon the usefulness of the expert target shot, who depends upon the perfect condition of his weapon, the accuracy of his ammunition, and the complete control under the most favorable circumstances of the breathing of the marksman and of his muscles. None of these can be depended upon with any degree of certainty while on active service.

It was proved conclusively in South Africa that great accuracy in rifle shooting at large, clearly defined targets, and at long ranges which were definitely and accurately known, is of little avail in active service, as the necessary conditions cannot be reproduced. This does not mean that great accuracy of rifle shooting is not useful at shorter ranges where all these disturbing conditions have less influence. It is laid down in the British Army training that accurate shooting at from 200 to 500 yards is of extreme importance, provided it is combined with great rapidity. Maximum rapidity of fire with individual accuracy at long ranges is, however, not worth working for, because it cannot be maintained under service conditions.

Concentrated Volley Firing.

The realization of these facts at once completely changed the training the individual soldier undergoes in the regular army. Previously efforts were made to train the men individually for long range shooting, but now they are not so trained as individual shots. Not only is it a question of barrel, ammunition and the general condition of the rifle, but there are other factors causing inaccuracy, such as barometric pressure, weather, temperature and the fact that it makes a difference whether the firing is along a horizontal line of sight or up or down from the horizontal. All these points have a serious effect on target accuracy at long ranges.

Instead, therefore, of attempting to train each man to shoot with extreme accuracy at ranges beyond 500 yards, an effort is made to use the rifles of companies or half companies as one firing machine, and to turn the stream of bullets into any area it is desired to beat with fire. This new system requires a quite different type of skill. It is first necessary to have a very highly trained firing leader who can judge distance accurately either by eye or with the aid of a range finder, and who has some way of indicating to the men who constitute his firing machine, what target he wants them to aim at.

Standardizing Rifles.

Before he can get his machine at work, although he knows how to judge distance and indicate targets to secure proper results, he has to standardize his rifles by some method which can be used in the field, and which, therefore, requires no complicated apparatus. When the rifles are thus standardized, each man can be instructed as to the range at which the backsight of his rifle is to be set to get the range desired. Rifles have been found on examination to be really ranging at 1,200 yards when the backsights were set at 1,500. Thus on service, a fire-leader must have each rifle standardized, be able to demonstrate targets, to judge distances, and to judge ground in relation to rifle firing. Many good fire-leaders were in the divisions which first went to the continent, but the casualties amongst them have been enormous.

The method of standardizing rifles is very simple. It requires an open stretch of ground and a vertical target—a barn wall or a screen or even a tree will do. Thirty yards away, the rifles are aimed at the ground line with various elevations and the point of impact marked, and from this the true range can be obtained by reference to range tables, the height above the ground being the determining point. The judging of distance is most elaborately studied.

Accuracy of Observation.

On the first day when the class arrives at Hythe to undergo instruction the men are led out to the seaside grounds, over which the school has absolute control, and asked without any previous warning to say within three minutes how many dummy soldiers are to be seen in front. On one occasion out of a squad of seven, one man saw one dummy and others various numbers, while one man saw over twenty. In reality there were fifty dummies exposed. This part of the training is to teach soldiers to observe accurately what they see.

Next it is necessary to teach the men certain standard distances first over flat ground, then over water, then over hilly ground, and then from a low point to one up a hillside; and finally from a hillside down into the valley. These standard distances are seen and re-seen until everyone is more or less familiar with them, and with the apparent sizes of dummies at these distances.

When new men become proficient in the elementary part just described, they

*From a paper read before the Canadian Society of Civil Engineers.

are given instruction of a more advanced character. First, they are taken to a hillside which commands some miles of open country and told to listen. Two or three shots are fired with blank cartridges by a man who stands up for four seconds after firing, and then disappears into the gorse or behind a wall. Each member of the class has to adjust the sights of his rifle to the range for the distance at which he estimates the man was. This is carried on until a fair standard of accuracy over the different types of ground already referred to is attained.

Judging Concealed Fire Direction.

In the next stage of instruction the firing is carried on out of sight and its direction has to be judged. After one has learned to judge the direction of firing—and that takes some men a long time to learn—the next step is to range on the nearest fold in the ground which might conceal the firers. The firer is never exposed at all, and it is extraordinary how, after training, men can accurately by sound and observation of the ground, discover the probable location of the enemy, and get his range. Once this elaborate instruction is gone through, by eye, with the instructors checking the distances accurately, men are taught the use of the range finder, but judging distance under service conditions is put first.

The fire-leader is now instructed how to indicate targets so that he can switch the whole of the fire of his machine on any point he desires. In service a target is seldom a very visible object. It may be a line of heads at a thousand yards, perhaps merely a fold in the ground, a hedge or a house, but whatever it be, if the machine composed of a company, a half company or a section is to be used properly the target must be absolutely pointed out to every man who is in the formation.

Influence of Intervening Ground.

After the fire-leader has learned to judge distances and to properly indicate targets, he has to study the effect of ground shape upon his rifle fire. Rifle fire at short ranges, especially with the modern rifle and high velocity bullet, such as used in the German and English armies, with an initial velocity of 2,400 feet a second, requires very little special sighting anywhere within a range of 600 yards, and so long as the ground is horizontal the fire is easy to control. With a rifle fired from a prone position, the trajectory up to 700 yards, is well below the head of a cavalry man and not much above the infantry, and at 600 yards or less it is well below the head of the infantry.

With these bullets and such trajectories, it is obvious that, for service work, sighting—but not aiming—hardly matters at all inside of 500, 600 or 700 yards' range because if a man lying on the ground fires at the ground line at any man approaching in the erect attitude on horseback the latter will be hit somewhere, and that enables a battle sight to be used. Of course, this is quite distinct from target shooting, for the object is to hit to kill and sighting does not alter very much unless the ground has a dip into which the enemy may sink.

At say 1,000 or 1,500 yards conditions are completely changed, because the bullet is coming down so steeply that the dangerous area is smaller, therefore, the nature of the ground is of great importance. From 600 or 700 yards outwards, then ground becomes more and more a consideration in relation to rifle fire. At a range of 2,800 yards, the culminating point of the trajectory is reached between 1,600 and 1,700 yards, the bullet then being at a height of 600 feet above the horizontal line of sight. It is this great height of trajectory at the longer ranges which is so important. A bit of ground that followed the trajectory in its curve would be a perfectly ideal field of fire because from the muzzle of the rifle to a distance of 2,800 or 3,700 yards, which may be taken as the extreme range of the modern British rifle, the whole area would be dangerous space, and nothing could advance. Such bits of ground occur only rarely, but they are to be found, and it is to make use of them that fire-leaders have to be trained.

Rifle Fire Defence.

The ground, therefore, has a great influence upon the defence of a position by rifle fire, and determines the type of position to be selected for defence. Of the stream of bullets sent out from a single machine gun or the rifles of a company, the best directed fifty per cent. furnishes a nucleus of the action of fire. Rather more than fifty per cent. of the bullets are effective from the point of view of beating ground, but not of killing the enemy.

With fairly good shots and with rifles recently tested and directed by a good fire-leader, about 75 per cent. of the bullets will fall within the really effective area. There will be a certain spreading out of the nucleus by the creation of a larger dangerous area on downward slopes. With ground which slopes upward from the line of sight, it follows that if a company is forced to occupy a position with rising ground near it, the leader cannot hope to develop any very great fire effect against the enemy while the latter are descending the slope. On the other hand, the enemy while on the top of the slope cannot develop any great fire effect against the company because their fire will of necessity be a more or less plunging one on account of the downward inclination of the line of sight, and a plunging fire gives so small a dangerous area that it is likely to do but little damage.

It is recognized with all the influences which exist to make ranging difficult, that it is practically impossible for any man, however skilful, to judge the proper range at which to set his sight. Although he may judge the distance perhaps within a hundred yards, that will not help him much if the range is 2,800 yards where there is a fall of about 137 feet in the last 100 yards of the bullet's flight. It is not only difficult to get the exact range, but also to get the barometric and temperature effect of the air. To overcome these difficulties, a device known as "combined sights" is adopted—that is, making part of the firing machine fire at one range, and part at another, say half a company at 1,400 yards and half at 1,550, which spreads the nucleus of the fire zone.

"Combined Sights" Device.

With accurate ranging, the nucleus of the beaten zone will fall within the required area, but without such accurate judging there will be no effective beating of ground where it is required, or the nucleus may only touch the edge of the required area with too thin a shower of bullets to do real damage. It is therefore frequently necessary to use combined sights, so as to get a greater searching power and depth in the zone of fire. In searching ground, the same aiming mark is used throughout one search, but the range is progressively increased or decreased, so that a strip of ground is beaten for perhaps a mile in depth and then another strip is beaten, and so on until the whole ground is searched in strips.

Similarly, sweeping may be carried out by changing the direction of fire crosswise—or searching may be combined with sweeping—so that if there are four companies in action, two are searching and the other two sweeping, two working fore and aft and two working backward and forward across the front allotted to them. In this way the greatest possible psychological effect that fire can produce is obtained. A dropping fire does not disturb men very much after the first few minutes because so few men get hit and there is so long an interval between hits that no one gets nervous, whereas, if heavy fire is brought to bear with a sudden rush on one part of the line and suddenly switched to another, each bit of the line struck by the gust of fire is not only materially damaged but the men are also correspondingly distressed, which puts their shooting out more rapidly than anything else. When men are demoralized by heavy casualties around them their shooting is likely to be very poor.

After all this long range and collective

firing practice, the training in the British army has another feature, viz., individual snap-shooting. Suppose that men are attacking a position and have fought their way forward under the command of their fire-leaders until they have reached a position of say 200 to 250 yards from the enemy, at which point they are unable to advance further because any man who stands up is immediately shot. It is at such critical stage of the attack that a special phase of the battle develops. It is the crisis of fire, and has for its object the winning of either material or psychological superiority for one side or the other, in order that one of the forces may charge home and close with the bayonet.

Rapid, Accurate Fire at Short Range.

At short range, material as well as psychological superiority is gained by putting the fear of death into every man on the other side every time he moves, and that can be done only by extraordinarily rapid shooting with extreme accuracy, so that every time an enemy's head appears around a stone, through a loophole or over a cover, it is at once greeted with a stream of bullets all around him. Once the enemy's head can be kept down in this way there is nothing to stop the bayonets—and it is with the bayonet that the decisive results can be obtained. An effort is made to get the troops so close to the enemy that they can use this rapid and accurate short range fire to which they are trained. In short range fighting the men have to act individually because there is no time or opportunity for any command. They fire whenever possible and when the fire-leader has got his men to that position and feels that they will win moral superiority he is ready to make his final plans to close with the enemy.

Such, then, are the ideas which have been the basis of training of the British regular army in the last few years. The actual course of training is of extreme interest. At the great ranges at Hythe there are thousands of dummies which can be moved with great realism in almost any direction and at almost any speed. Even dummy cavalry can appear, gallop across the plains and charge. Guns appear and gallop into position, and the whole range is really a maze of mechanical devices to secure the movement of different sets of dummies.

The Dummy Feature of Training.

One of the most interesting features there shown, is a small position definitely prepared for defence by a hundred men. In front of that position, extending for about 300 yards, is ground over which dummies are arranged to advance and attack. As a demonstration a hundred really good shots are selected and instructed to hold the position while they are attacked by the dummies, and each given 150 rounds of ammunition. The dummies begin to come forward in definite infantry attack formation from the extreme limit of the range. The attack develops and is pressed home. As a rule, the dummies are practically untouched, and the men who defend the position, these good target shots, are in a condition bordering upon physical collapse from fatigue after trying to fire 150 rounds with extreme rapidity.

The continual discharge of the rifle is very fatiguing in itself. Rapid rifle firing after 100 rounds is no joke becase the barrel gets very hot and the kick very savage. As a contrast a series of recruits from a line regiment, who have done no firing, except at short ranges, but have been carefully trained in parade and field in recognizing targets and snapping without firing, are placed under command of five good fire-leaders. One of the fire-leaders is a company commander, and the other four are section commanders. These much poorer shots, not through any virtue or merit of their own, but through the skill of the firing commanders, are able to inflict hits upon between 70 and 80 per cent. of the dummies in attack. That, of course, would not be reproduced in a real attack, because the enemy would be firing at the holders of the position, and the fact of being fired at has, with all but the most experienced veterans, a certain disturbing effect. It is, nevertheless, wonderful how little difference it makes to men after a few days.

Close Order—Effect of Rifle Fire.

The next practice for demonstration is intended to prevent mistakes in formation, and shows the effect of rifle fire upon troops in close order. A series of screen are put up to represent a battalion in quarter column, with its eight companies close together. A party of green shots led by an experienced fire-leader have to deploy into position about a mile away from the screens. Sitting amongst these screens in little metal beehives, closed against the fire, but open on the other side, are the officers to be instructed. Firing is opened under direct instructions as to range, and 100 rifles working their hardest for a minute means that about 2,000 bullets are dropped in the striking area in 60 seconds.

To sit in one of these beehives is a liberal education, for before the reports of the rifles are heard the ground begins to boil. Stones jump and smash through the screens with the whizzing of bullets, and then the noise of the firing comes, and within a minute all the screens are wrecked, the poles are smashed, and everything comes to pieces. The same experiment repeated with good shots without fire-leaders in the same circumstances, is also instructive. Usually nothing happens, the men apparently judge the distance wrongly and, breathing fast after a rapid advance are not able to hold their rifles steady on the target. It is through such practical demonstration that infantry officers and men in the British Army are trained.

General.

No attempt has been made in this paper to elaborate points in connection with the use of the rifle, but simply to indicate in a general way the lines along which the British army is trained and along which all the forces of the British Empire are asked to train themselves, although many of them have not as yet responded to that invitation.

There are still men who are in the position of leaders of troops who hold out for long-range target shooting as though it had proved to be of real value in the field, whereas it has been found in actual service to be of almost no value at all. It is excellent elementary practice, teaching a man how to handle his rifle properly and keep it steady. The British War Office has been seeking to get the competitors at Bisley to agree to a complete change in the type of competitions, introducing service conditions, and it is only because the men who are interested in "pot hunting" do not understand the more serviceable type of shooting that an agreement has not yet been reached.

Of course the war has stopped this discussion, but unfortunately it has not stopped the results of the different types of training. There are troops with the Allies who have been trained on the old theory that everyone must be a good target shot to be useful, and in the idea that the officers have comparatively little to do with the shooting; whereas the officers, n.c.o's, and squad-leaders who control the fire are really the men responsible for the shooting of the whole machine.

Kitchener and the Office Boy.—An amusing story has been going the round of the Tyne shipyards concerning the recent visit of our King, accompanied by Earl Kitchener, to certain local works. The Royal party was in the drawing office of a celebrated firm on one occasion, when the door opened somewhat noisily, and a youth entered, apparently in ignorance of the presence of the visitors. "You are not one of the draughtsmen, are you?" inquired his lordship of the newcomer. "No, sir, I am the office boy," was the reply, given with such an air of self-importance that the habitually stern face of K. of K. relaxed. Turning to the King, the War Lord gravely exclaimed, "Your Majesty, the office boy."

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

CHATTERING TAPER REAMERS.

By J. C. Klasen.*

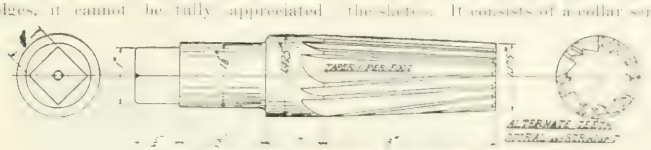
THE writer was much interested in your article in the June 17, 1915, issue of Canadian Machinery, page 519, on "Chattering Taper Reamers," from Herbert's Monthly. No doubt all that was said will be quite readily agreed to by those who have attempted to produce large numbers of reamed taper holes, which had to be perfectly smooth and accurate.

Recently the writer had a large quantity of taper holes to be reamed in brass castings, which were used as quick-make-and-break couplings on a compressed air system. These couplings had to be interchangeable, thus grinding to fit in pairs was out of the question.

From previous experience with the standard taper reamer, I knew that it would not do very satisfactory work, and, if possible, I wished to use power for operating the reamers, as considerable material had to be removed. The accompanying sketch shows the reamer we adopted for this work.

You will note that spacing of the teeth is quite coarse, being quite reverse to the usual practice, but quite necessary for rapid removal of stock.

The main feature of the design of this reamer is in the alternate straight and spiral or "backward" teeth. This prevents the reamer from "hogging in," and permits power to be used to drive it. The holes that these reamers produce are as smooth as can be desired, and unless a person had actually tried one of them into a reamed hole by hand, and felt the velvety action of its cutting edges, it cannot be fully appreciated that for a taper reamer, alternate straight and "backward" spiral cut teeth certainly seem to be the correct design.



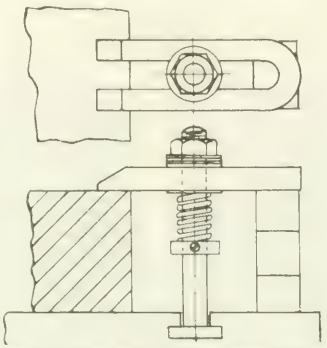
LARGE SIZE "B & S" TAPER COUPLING REAMER

*Master Mechanic, Canada Consolidated Rubber Co., Berlin, Ont.

A STRADDLE-CLAMP SUPPORT.

By J. E. Cooley.

ON planers, millers, and other machines where straddle-clamps are used to strap down work, a great deal of time is lost through what might be called a "wasteful method" in handling these tools. Where several of these clamps are used together, and each one is removed from the bolt and work, and thrown on the floor or dropped down somewhere after an operation is completed, it is readily seen how wasteful this proceeding is. There is seldom any need to remove the straddle-clamp entirely away from the bolt, or let it even drop down, in order to remove the work from the machine. It is only necessary to provide some means to keep the clamp upheld, so that it can be drawn back sufficient to clear the work.



COLLAR AND SPRING FOR STRADDLE CLAMP

A useful time-saving suggestion by which a straddle-clamp can be kept in position while work is being placed or removed from the machine is shown in the sketch. It consists of a collar screwed on the bolt a suitable distance below the clamp, on top of which is placed a spring and washer as shown. It is readily seen that when the nut is unfastened, the spring causes the clamp to lift up, so that it can be drawn back from the work.

One length of spring can be used for different lengths of bolts, it being only necessary to set the collar so that the spring will have a slight tension under the clamp after the nut is unloosened.

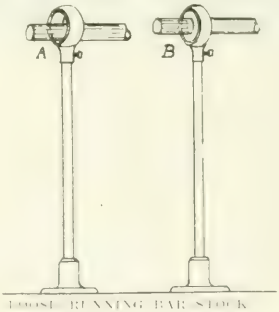
UNNECESSARY NOISE IN MACHINE SHOPS.

By E. C.

A GREAT deal of the noise made in machine shops is unnecessary. In order to produce good work, and in order that workmen shall not have their attention attracted away from same, it is important to eliminate as much as possible all unnecessary noise. While all noise cannot be entirely done away with, it is possible to reconstruct some of the means that produce it so that the sounds will be considerably lessened.

Attention is called to the unnecessary noise made in having bar-stock run loosely in the upright supports that are fastened to the floor near the ends of screw machines and turret lathes. Everyone is familiar with the rattling and banging noise produced, especially when the speeds are changed or reversed, as required in running a die off a thread.

This noise is caused by using only one size stock-holder, in order to take in all the different diameters of stock in one machine. An example of this is shown in the illustration at A. If separate stock-holders are used with holes of the same diameter as the bar-stock, as suggested at B, this noise would be greatly reduced. The holder is fastened to the rod by means of a set screw. Several of these holders could be made up and marked, and kept together in a box always ready for use.



LOOSE RUNNING BAR STOCK

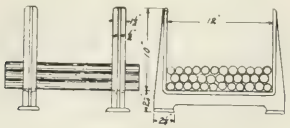
SHAFT RACKS.

By C. James.

WHEN piling small shafts on a work bench the general method is to stack them up pyramid fashion, supporting them on the sides by means of nails or pointed rods driven into the bench. This method is not always dependable, as the

nails or rods often give way, letting down the shafts with a great noise and confusion. Another objection is that more space is taken up than really necessary.

In the enclosed drawing is shown a neat and reliable arrangement for holding a considerable number of shafts in a limited space. It consists of two light yet substantial cast iron racks, that are



SHAFT RACKS.

"stood up" near each other on the work bench, the shafts being placed across them as shown.

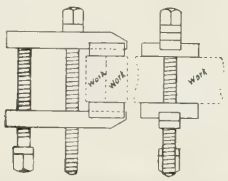
The racks as seen in the drawing are made up to hold 100 shafts of 1-in. diameter in a space of 10 in. by 12 in.

GROOVED BLOCKS FOR HOLDING WORK PARALLEL.

By J. Hartford.

IN making a jig or doing any accurate tooling, it is sometimes necessary to hold two pieces of work together parallel for the purpose of drilling or filing them, etc. For this means two steel blocks are placed against the work and fastened on with a parallel clamp.

In manipulating the blocks, they often slip away and fall to the floor, or they are not placed satisfactorily in the clamp after the screws have been drawn up. In the illustration is shown a useful "kink" that may be of interest to machinists. It consists of cutting a groove in the blocks so that they can be slipped on the clamp as indicated, there-



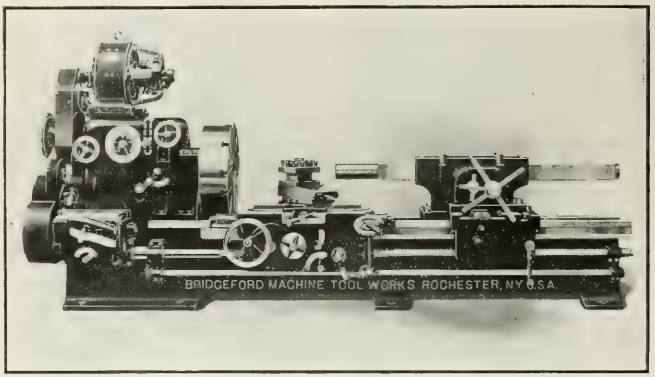
GROOVED BLOCKS FOR HOLDING WORK PARALLEL.

by keeping them from falling from the clamp, and maintaining them in an upright position when the screws are tightened.

TURNING AND BORING LATHE FOR LARGE SHELLS.

IN order to meet the demand for machinery for the rapid production, both in turning and boring of large shells, the Bridgeford Machine Tool Works of Rochester, N.Y., have taken their 32-in. heavy pattern triple-geared head engine lathe and arranged it with devices that permit of maximum production up to the limit of the best high-speed steels. The lathe is up-to-the-minute in design, is a powerful, well-built tool, and, on a 32-in. diameter, delivers a pulling power of approximately 17,800 lbs. at the tool.

A power-fed tail block of massive construction can be supplied, which makes the boring of large shells a simple and rapid operation. The bar, which is 5½ in. diameter, and bored and reamed for No. 7 Morse taper, is arranged on a swivel so that either straight or taper holes can be bored without using the taper attachment. The power for operating the bar is taken from the lead screw and transmitted to the bar through gearing. In addition to the power feed, there is an arrangement



TURNING AND BORING LATHE FOR LARGE SHELLS.

whereby the bar can be traversed by hand, either slow or fast, as desired by the operator. The large handwheel has two positions—one for fast movement, and the other through back gears. The small handwheel is for engaging or disengaging the power feed. There is cross adjustment for the tail block, also lateral adjustment along the bed. A four tool steel turret on the compound is of great assistance in the rapid and economical handling of the work.

The lathe shown is driven by a 18 h.p. Westinghouse variable-speed motor, and controlled from the carriage by the use of a Westinghouse drum-type controller, which is placed on the rear of the frame. This enables the operator to control the motor from the carriage and change from slow to fast speed or vice versa, without leaving his position at the carriage. Without a motor the head block gives fifteen mechanical speed changes in geometric progression, but when the lathe is equipped with variable-speed motor drive, these fifteen speeds are multiplied by as many points as there are on the controller. The quick change gear box enables the operator to obtain instantly any desired feed.

A number of firms with these lathes in operation have, we understand, equipped them with side turning or full swing rests, and, when so equipped, they are able to take care of large shells to the best possible advantage.

OIL IN MOTOR WINDINGS.

By A. F. Adams.

ON a 400 h.p. induction motor we have had considerable trouble with oil getting into the stator windings. The oil apparently worked out around the plugs, inserted in the bottom of the oil well for draining the bearings, and also around the connection, where the gauge glass is placed.

Several times the plugs had been taken out and cleaned, and, as the threads in the castings were in good condition, also those on the plugs and gauge glass connections, they were replaced. Each time that this was done, however, the leakage seemed worse, drops of oil would form on the bottom of the bearing and on the outside, and, due to the current of air which was generated by the fans of the rotor, a portion of the drop of oil would be deposited on the windings.

As something had to be done, we scraped the paint off of the casting where the plug and gauge connections were and found our trouble. A portion of the casting seemed to be porous, and this was where our oil was coming from and not from the drain plug and gauge connection as had been supposed.

We successfully stopped the trouble by putting a piece of condenser tube packing around the plug and leading it to the floor. All of the oil goes down the string, and the windings are perfectly dry. Any piece of soft cord will answer the same purpose.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

VAULT FEATURE, DOMINION BANK BUILDING, TORONTO

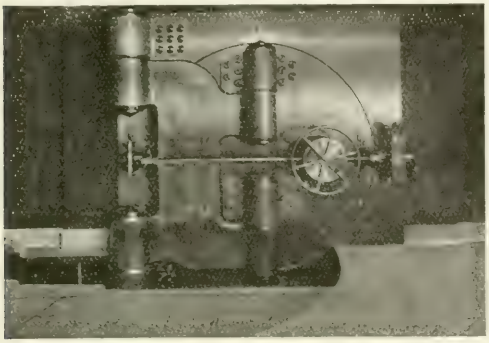
NOT the least attractive feature of the many such to be viewed in the design construction, equipment and appointments of the new Dominion Bank situated on the south-east corner of King and Yonge Streets, Toronto, is the great vault, admitted to be the largest as well as the most complete in Canada. The approach is by the broad marble stairway leading from the savings bank department down to the public space separated from the vault lobby by a massive steel grille with bars one and one-half inches thick, spaced four inches on centres, and reaching from the floor to ceiling. The vault is erected entirely separate from the building construction, and is approximately 33 feet square by 25 feet high; divided into two stories, the upper or safe deposit vault, the lower or treasury vault.

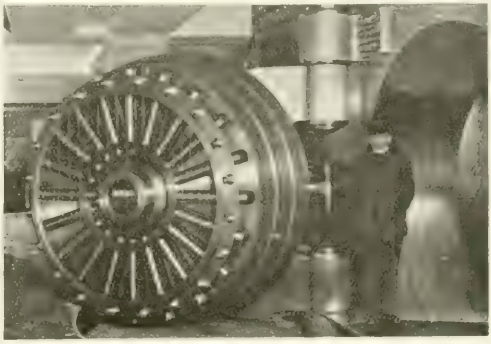
Protective Devices

Surrounding the vault is a patrol passage 3 feet in width. At the corners are placed heavy silvered glass mirrors, full depth, and set at such an angle as to permit of free observation on all sides; while similar arrangements have been made above and below, so that no exposed surface escapes the attention of the guard. Lights with silvered reflectors are arranged by means of removable parts so that the entire length of the observation space is well illuminated. Even the bottom of the vault is constructed in such a manner as to remove all possibility of tunneling. Upon the solid rock-bed, 18 inch steel beams encased in concrete form a series of piers which support the vault, and at the same time permit an unobstructed view of all open space beneath.

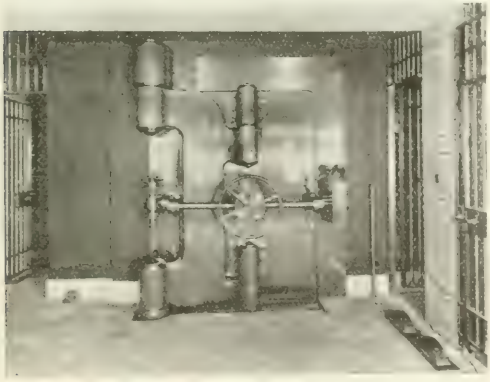
Directly over the observation tunnels just mentioned is a 28 inch floor, the construction of which consist of reinforced concrete, closely staggered iron grillage, 2½ inch steel lining, and tile laid upon a cement base. The walls also are similar in thickness to the floor, built up of 2½ inches of shock and drill-proof steel surrounded by 2 feet of rock concrete. This concrete is made impervious to fire, shocks and acid applications by having two rows of heavy steel beams embedded within. The entire outside surface of laminated lining is waterproofed by two layers of heavy tar paper with applications of hot tar on both sides.

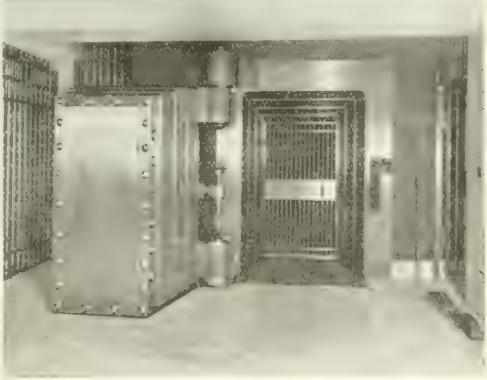
To enter the safe deposit vault it is necessary to pass through one of the





TWO VIEWS OF CIRCULAR DOOR TO SAFETY VAULT, DOMINION BANK HEAD OFFICE BUILDING, TORONTO





TWO VIEWS OF ENTRANCE DOOR TO TREASURY VAULT, DOMINION BANK HEAD OFFICE BUILDING, TORONTO

largest and heaviest doors ever built. It is circular in shape, 2½ feet thick, weighs more than 30 tons, and has a clear opening of 7 feet 6 inches in diameter. The door guarding the treasury vault below is of the same thickness and construction, but rectangular in shape.

The doors are of composite construction, the outer half formed of low steel castings containing 10 inches of concrete; interlaced refractory steel members 1½ inches in diameter, by 4 inches on centres; and an outer burner proof metallic section. The inner half is built up of seven parts each of 2 inch thickness firmly welded together; three layers of five-ply chrome steel plates; four layers of low steel and solid cast steel bolt frames. With the exception of two narrow rebates, there is no short stepping and no customary tongues and grooves.

Lock Mechanisms

A feature of unusual interest is the locating of the combination locks and bolt-throwing mechanism on the door jambs and the time locks upon the doors proper. The arrangement necessitates the putting of holes through both the jamb and the door in order to reach the dogging devices in burglar operations and provides doors solid and without spindle holes. All locks and bolt-throwing mechanism are covered with heavy steel plates, while the combination dial is in shape of a steel cylinder disappearing angle-wise in the top of the front pressure housings. The front end is provided with an oval glass window, behind which appears an electrically illustrated dial with two revolving pointers which are connected with operating knobs located on the side of the housing, used to set the combinations of the locks. The device is not only one of convenience, as the cylinder is located upon a normal line of vision, but absolutely prevents any unauthorized observation of the setting up of the combination numbers.

The doors are hung upon massive steel crane hinges provided with ball and roller bearings and so carefully balanced that they are easily manipulated. They are steam tight and locked with a train of twenty holding bolts, 4½ inches in diameter. The bolt work is covered with sections of French plate glass, at the centre of which is a circular glass door 15 inches in diameter. The outside ring of glass is one piece without radial frames, set with a grey invisible packing.

A special foundation of concrete has been set in front of the entrances for the support of the mechanism, whereby sections of the floor are dropped by the use of a hand lever to permit the opening and closing of the doors and then raised and locked in position to complete the floor levels.

Electric protection has been installed so that in case any attempt has been made to drill through the walls or doors, or should the doors be opened in any unauthorized way, three large gongs sound an alarm, one being located upon the exterior and two upon the interior.

Safety Deposit Vault Equipment

The safety deposit vault is equipped with more than a thousand boxes of various sizes, finished in polished steel, locked with the latest interchangeable key locks, and provided with an enamelled bond drawer. The vault has a polished steel grille and gate located directly within the main vault entrance. The floor is tiled with marble slabs, the joints being "struck" with monel metal bars. The walls and ceilings are panelled with steel plates and bars, and the lighting is furnished by a double system of electric equipment so arranged that the vault cannot be thrown into darkness by anyone except the proper officials.

Within the vault is a telephone which allows a means of outside communication by any person accidentally locked in at night time. If such an accident should occur the prisoner will find a pair of lights burning and a card of instructions advising whom to call and how to release the time lock devices, after which the combinations can be operated. Large volumes of fresh air are constantly delivered into the vault, the circulation of which is augmented by fans.—Cuts Courtesy of "Construction."

SEVEN MISTAKES OF LIFE.

Here is an American editor's enumeration of the seven mistakes of life:

1—The delusion that individual advancement is made by crushing others down.

2—The tendency to worry about things that cannot be changed or corrected.

3—Insisting that a thing is impossible because we ourselves cannot accomplish it.

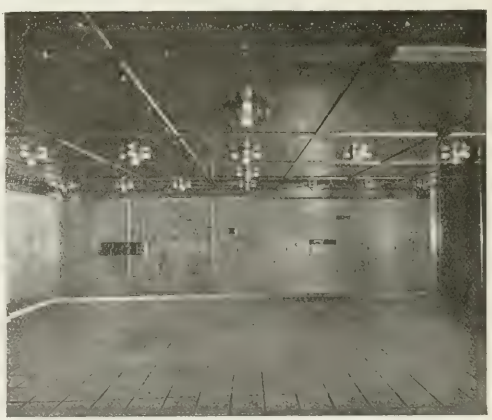
4—Attempting to compel other men to believe and live as we do.

5—Failure to refine the mind by acquiring the habit of reading good literature.

6—Refusing to set aside trivial preferences in order that important things may be accomplished.

7—The failure to establish the habit of saving money.

STEEL GRILLE IN FRONT OF SAFETY VAULT



INTERIOR OF SAFETY DEPOSIT VAULT

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THE WAR A TEST OF ENGINEERING SKILL AND CAPACITY.

WE are now into the twelfth month of the war and evidences are not lacking that its duration will be at least as long again. A feature of it, however, that seems to have been given little consideration relates to the part our Empire has played and is still playing by virtue of its having become one of the combatants.

In submitting the view, that, long ere this, Germany would have over-run the whole of Europe and have become a menace to world freedom, but for British intervention on behalf of the latter, expression is given to the thoughts and ideas of all who have followed the course of events in the various theatres of conflict since last August. Too sanguine expectations seem, however, to have been formed as a result of our entry into the conflict—in a word, too much seems to have been taken for granted in the matter of our preparedness to make a swift and effective onslaught on our enemy and all too little was known of his highly developed fighting machine, its engineering supplement and mainstay.

When the inside history of the war comes to be written, it will be found that resourcefulness and deeds of valor or far-flung battlefields—of the type and nature chronicled in other conflicts, sea and land, may have to give pride of place for the first time to engineering expertness, ingenuity and constructive ability. In a word, the requirements of any combatant nation are, if success is to be attained, that the industries of that nation, and particularly those relating to engineering and metal-working be enlisted and mobilized for service. Mobilization of industry did not materialize in Britain with that of her standing army and her fleet, although now it is realized that such a step should have been taken. The man as in the past was reckoned to still have implanted in his nature grit superior to that of any adversary and to be at least a match.

Among other things these months of war have taught us, however, is that individual men in even overwhelming numbers are only of value when supported by the products of our workshops and factories. We need, it is true, all the men we can get, and we want a great many more to offer themselves; incidentally this is a particularly pressing matter with us to-day in Canada. We need more than men, however, we need engines and munitions of war, but as in the case of the Motherland, we have gone into the manufacture of these in that more or less spontaneous, unsystematic manner that marks our race.

As has been said, there was no Imperial command to put every lathe, tool and forge at the service of Empire. We simply have taken advantage of the opportunities afforded of Government work, realizing that thereby we were helping out in the task of subduing Germany, and incidentally helping ourselves. We have been manufacturing shells and having had several months practical experience of the work, we had got to the stage at which not a little pardonable pride was being taken in our achievement, but our shell products, although as called for, are incomplete for service. We are now asked to make them so, it only being realized at this late day that shipping empty shells either to Britain or France is a clumsy, uneconomical and unbusinesslike proceeding.

Compared with our shell forging and machining plants, those equipped for adding the "fixed ammunition," are away less than a handful. Wherever the blame for the present state of affairs may be placed, much unnecessary heart-burning and confusion is likely to result in our shell shops. Sufficient enterprise should have been shown by our Department of Trade and Commerce to make suggestion to the British War Office that our Canadian plants were both equal to the task and were prepared to furnish shells ready for the gun batteries.

Canada would have been unanimously at its back if it had demanded from Lord Kitchener why orders for millions of completed shells should not be given to our manufacturers. If Schwab, with the United States Consular service at his back, could sell to the British War Department, why could not Foster do the same thing with Canada at his back? Obviously we need a business, not a political engineer at the head of our Trade and Commerce Department.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.15
Steel bars, f.o.b., Toronto	2.15
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled.	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	5 00
Tea lead	$ 3 50	$ 3 75
Scrap zinc	12 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	32½	....	....
½ in.	68	41½	....	....
¾ to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
½ to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 50	$21 50
Electrolytic copper	21 25	21 25
Castings, copper	21 00	21 00
Tin	45 00	46 00
Spelter	28 00	28 00
Lead	7 50	7 50
Antimony	40 00	40 00
Aluminum	40 00	40 60

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings. 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.73
Linseed oil, boiled, sinble bbls.	0.76
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	Price list withdrawn.
At warehouses	

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 50
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	6 40	6 40
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	6 30	6 30
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	6 30	6 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6 25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4 00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., July 5, 1915.—The demand for machine tools of all kinds, particularly engine and turret lathes, continues very brisk with deliveries promised three months from date of placing order. In this line there is a wider and more promising outlook than appears at first sight. For example, with the pressure to which machine tools are being subjected, the night and day shifts, coupled with the added incentive of piece-work prices, the life of equipment at present in use will not be of long duration. In other words, even in plants now fully equipped, there will be a steady and consistent demand for new machine parts and also complete machines.

Just at present, according to some machine tool users, there is great opportunity for the manufacture of lathes, shapers, presses and milling machines. On the other hand it is claimed that after the finish of the war there will be a glut of machine tools on the market. This latter argument is, however, refuted by the fact that even for the duration of the war most shops will have to renew their equipment units entirely.

There is not much difference in prices of electrolytic copper between New York and Montreal, the price in the former place being one cent a pound cheaper than locally. August deliveries are offered at 19¾c cash New York. The outlook is that the price of copper will con-

time to soar owing to increased consumption on account of war demands, it being highly problematical as to whether production will keep pace with the consumption. The opinion of leading military authorities seems to be in agreement that the war has yet two years to run. All this is more or less guesswork, however; at the same time there is considerable capital invested on the strength of such a long drawn out struggle. Finished steel prices have been extremely well maintained.

Antimony still continues at 40 cents a pound., which is a considerable increase from 7 cents, the ruling price in the ante bellum days. The demand in this country for antimony is large and persistent.

The price of tin has not shown any great variation in spite of the fact that consumption is fairly strong.

Aluminum is quoted at 40 cents, but buyers seem reluctant to pay this price. Bids of 38c have been made, but nothing seems to be available at that figure.

While metal prices generally have been rising steadily, the price of second-hand lead is quoted at 4½c, with more frequent offers and prompt deliveries. In fact, most all waste metals this week show a considerably easier feeling, with red brass and red brass turnings down one cent.

The recent flurry in spelter prices which, it is alleged in some quarters, were deliberately marked down to facilitate the purchase of low-priced concentrates by the very people who will be interested later in getting as high a price as possible for the refined product, did not have any lasting effect on the market. There was a rumor that manipulative tactics were being resorted to which caused the prices to remain firm. There is every evidence of a fresh buying movement being close at hand.

While no large contracts are yet being booked, there are many inquiries in the market. The way things are going, the "stand-patter" is about on an equal footing with the more venturesome. Just to demonstrate what the activity is in this metal, the New Jersey Zinc Co. has declared an extra cash dividend of 30 per cent. It is also rumored that their capital stock will be increased three and one-half times.

Toronto, Ont., July 6, 1915.—The development of foreign business and the manufacture of war equipment, including munitions, are the chief matters of interest in commercial circles. With ordinary business dull and little prospect of any material improvement for some time to come, there is every incentive for our manufacturers to look to other fields rather than at home. As regards this new feature, prospects are improving and it is anticipated that not only will further war orders be placed with Canadian manufacturers, but also orders for equipment not necessarily for the allied armies, but as a result of the war. The contracts for locomotives and cars already placed will no doubt be followed by others. Shells for the Russian Government are being made here and it is expected that manufacture of shells for the French Government will be commenced shortly. It is expected that the visit of David A. Thomas, the representative of the British Government, will result in large orders for war material being placed in Canada.

COMING CONVENTIONS.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

Conrad F. Just, special Trade Commissioner for Canada to Russia, has sent an interesting report from Petrograd to the Department of Trade and Commerce. Mr. Conrad advises Canadian traders to organize on the basis of a close study of Russian requirements and to keep in touch with the consumer by means of local agents. He states that it is desirable to have assembling shops in Russia, particularly for machinery, thus effecting a saving on customs duties and permitting tendering on Government works.

Steel Market.

The mills have made an advance of $1 per ton on steel bars, plates and shapes, and quotations are now $1.25 f.o.b. Pittsburgh, with steel hoops at $1.30 at the same point. Canadian mills are quoting $2.15 f.o.b. Toronto and Montreal. Prices are very firm at the advance and may be raised again. The active demand for steel bars for shells continues with an increase in tonnage. Specifications for French shells have been issued and good business is expected from this source, as well as from Russia. Merchant business continues quiet, and statistics show a sharp decline in the building trade.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Since the last advance in galvanized sheets, the spelter market has been easier but is recovering. Prices of sheets weakened, but are firm again and another advance is probable, as the spelter market is stronger. The continued abnormal price of spelter is affecting the output of galvanized sheets considerably. Some makers have withdrawn from the market entirely and others are asking higher prices for their product. Galvanized pipe is firm at the higher prices announced last week and makers are seriously affected by the spelter situation. Cold rolled strip steel has advanced $2 per ton. Prices on cold drawn steel shafting have been withdrawn pending an advance which it is expected will be about $2 per ton.

In the United States the steel market continues active and prices on all products are firm. Further large orders for ammunition are pending and there is a big demand for high-grade bars for shells. There is a better demand for steel plates owing to domestic consumption, and also on account of big business being done in the ship-building industry.

Pig Iron.

The market continues dull and the situation shows no improvement. Prices are unchanged.

Scrap Metals.

Quotations on copper and brass scrap are holding very firm on good demand. Scrap zinc has recovered and has advanced, being now quoted at 16c per pound. Lead prices are firm but unchanged. The market for iron and steel scrap is quiet and prices unchanged.

Machine Tools.

The market is distinctly quieter as regards new inquiries, but dealers are busy filling orders already placed. Deliveries are no better, the ingenuity of makers and dealers being taxed to satisfy customers so that they may begin operations with as little delay as possible. Second-hand machines tooled up for making shells are being requisitioned to make up for the deficiency in new equipment. There is a temporary lull as regards new shell contracts and also shipment of shell cases, but when plants of sufficient capacity for turning out fixed ammunition have been equipped, there will no doubt be increased activity in the shell industry and interesting developments may be expected.

Supplies.

The supply business is very good and prices are holding firm. The demand is principally from the shell plants, although ordinary business is showing some improvement. There are no price changes to note this week.

Metals.

There are few price changes to note in the metal market this week, the single exception of aluminum, which has advanced, all markets are steady. There is a big demand for this metal and supplies are scarce. Tin is steady but has a weaker tendency, but the price is unchanged. Copper likewise is unchanged and the market stagnant. Spelter is firm at the advance announced last week and the situation shows no improvement. The lead market is weak but quotations generally are [illegible]. The antimony market is dull, but the position of this metal is good. The New York metal exchange was closed on Monday.

Tin.—The market is quiet with a weaker tendency in London. The consumption of tin is on the increase and higher prices may result. Tin is quoted locally at 40c per pound.

Copper.—The situation is unchanged. The London market is [illegible] increase in stocks of copper in England and France, while the New York market is stagnant, and prices unchanged. The consumption of copper continues [illegible] the enormous demand for ammunition. The copper position is therefore a strong one and higher prices are looked for. Local quotations for copper are unchanged at 27½c per pound.

Spelter. The situation continues serious and supplies are very scarce. Most of the demand is from the brass mills, but there is also considerable from galvanizers. The market is firm and unchanged with prices nominal at 28c per pound.

Lead. The market is lower in London but firm in New York. Producers are well sold ahead, and the market has a steadier tendency. Locally, prices are holding firm and are unchanged at 7½c per pound.

Antimony.—The market is dull, but is holding up well. With the increase in the demand for ammunition, there will be a greater consumption of antimony. Quotations are unchanged and nominal at 40c per pound.

Aluminum.—The market is strong and has advanced again. There is a heavy demand for this metal, and supplies are very scarce. Aluminum has advanced 5c and is quoted at 40c per pound.

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The Hudson's Bay Co. has been appointed purchasing agents in Canada for the French Government.

High Speed Steel Price.—Tungsten is [illegible] steels, its average being about 18 per cent. in every pound. As it has quite tripled in price within a short period, and is at that hardly obtainable, it was only reasonable to expect that the price of high speed steel would show a considerable and, of course, proportional increase.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, export rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne. Cable address, Canadian.

British West Indies.

E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Philippe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.

Hamilton Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbegd No. 4, Christiania, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Halifax, N.S.—The Starr Mfg. Co., have equipped their plant to make shells.

Truro, N.S.—The Truro Engineering Works, Ltd., have received an order for shells, and will proceed to install the necessary equipment.

Renfrew, Ont.—It is announced that the Smith mill owned by M. J. O'Brien will be converted into a machine shop and equipped with machinery for making shells.

Orillia, Ont.—The E. Long Mfg. Co. will undertake the manufacture of shells for the British Government. The initial order of 15,000 high explosive shells has been received.

Kingston, Ont.—A special committee of the city council have recommended that a boiler be purchased from the Jenckes Machine Co. for the proposed incinerator.

Welland, Ont.—William G. Edwards of the International Specialty Co., is planning to equip the plant with machinery to manufacture shells for the French Government.

Calgary, Alta.—The local branch of the Ford Motor Co. has secured an option on the property at the north-west corner of Eighth street west and Eleventh avenue, where it is planned to erect an assembling factory.

New Glasgow, N.S.—McNeil Bros., who are manufacturing shells, have leased the rink at Stellarton, which they will convert into a machine shop, in which shells and their parts will be made. New machinery costing $75,000 will be installed as soon as possible.

Municipal

Calgary, Alta.—The city is planning to build a big reservoir and a water filter.

Millardville, Ont.—The council are considering installing a waterworks system.

Collingwood, Ont.—The Town Council contemplate making improvements to the waterworks system.

The Pas Man.—A by-law will be submitted to raise $80,000 for the construction of a system of waterworks and sewerage.

Port Hope, Ont.—The by-law has passed authorizing an expenditure of $35,000 on waterworks improvements.

Whitby, Ont.—The completion of the sewer system is contemplated by the Town Council. A by-law will be submitted.

Kamsack, Sask.—The town council propose to construct an addition to the waterworks system, estimated to cost $35,000.

Lambeth, Ont.—The council propose to install a waterworks system, at an estimated cost of $15,000. Engineers J. A. Bell & Son.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

Vancouver, B.C.—Seven by-laws for the purpose of raising three-quarters of a million dollars were defeated by the electors on June 28.

Matheson, Ont.—A by-law will be voted on by the ratepayers on July 16, to raise $20,000 to pay for the construction of a waterworks system.

Vernon, B.C.—The city council propose to install an auxiliary pumping station at B. X. Creek at a cost of $3,000. Ald. Clement is chairman of the Water Committee.

Hamilton, Ont.—By-laws have been passed by the City Council authorizing the issuing of debentures for $250,000 for the city's and owner's share of the McKittrick bridge and waterworks extension.

Mimico, Ont.—With the closing of the deal between the Villages of New Toronto and Mimico, for a supply of water to the latter municipality, the Mimico Council immediately intend to proceed with the work of laying the mains.

Toronto, Ont.—W. A. McLean, Provincial Highways Engineer, reports that the Toronto-Oshawa highway constructed of macadam would cost $239,000, and if made of concrete $625,000. The cost would be divided among the various municipalities interested.

The Pas, Man.—The town has given notice in the current issue of the Manitoba Gazette of its purpose to establish a system of electric light and power in its municipality at a cost not to exceed $50,000. The money will be raised by sale of debentures. The by-law will be submitted to the electors on July 15.

London, Ont.—The city council are considering awarding the following contracts for machinery for the Springbank pumping station:—Motors to Canadian Westinghouse Co., Hamilton, at $6,400; waterwheels to Hamilton Co., Peterboro, at $7,595, and pumps to the John MacDougall Caledonian Iron Works, Montreal, at $4,710.

General Industrial

London, Ont.—The proposed breakwater at West London will probably be constructed of concrete.

Renfrew, Ont.—It is announced that the Jamieson Brick & Tile Co. will establish another plant here.

Owen Sound, Ont.—The Town Council has decided not to proceed with the scheme for building an elevator here.

Redcliffe, Alta.—A cyclone on June 25 did considerable damage to the planing mill here and several other factories.

Eburne Station, B.C.—It is announced that the B.C. Grinnell Glove Co., of Vancouver, will locate a branch of their business here.

Sorel, Que.—The factory of the Sorel Bottling Co., recently destroyed by fire with a loss of $7,000, will be rebuilt. New machinery will be required.

THE A. R. WILLIAMS MACHINERY CO., LTD
ST. JOHN, N.B. TORONTO WINNIPEG VANCOUVER
Canada's Leading Machinery House

Are You Going To Make Projectiles?

You will be interested to know that our Service Department,—organized specially to take care of your requirements,—can give you all the information on the most up-to-date methods used in the manufacture of Shrapnel and High Explosives.

Don't worry about the recent order closing manufacturers' shops to public inspection. Come and see us and bring your problems along.

This is the time when Service Counts—Write Us.

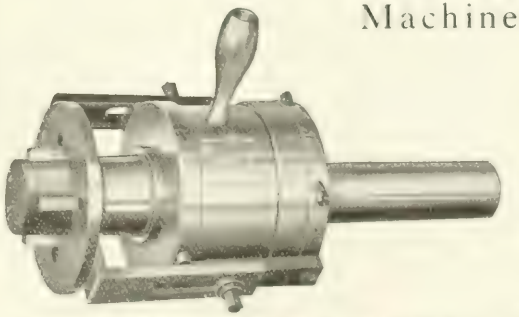
THE A. R. WILLIAMS MACHINERY COMPANY, LIMITED
TORONTO, ONTARIO

CONSIDER

What a Geometric Collapsing Tap Will Do For You

Send for our Catalogue. It tells the interesting story.

These Taps are used on Turret Head Machines or on Live Spindles.



Geometric Class NE Collapsing Tap as Equipped for Shell Work

Geometric Collapsing Taps are very busy at present on shrapnel work, but they are arranged for all classes of thread tapping above ¼ inch diameter.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN., U.S.A.
Canadian Agents

Sidney, N.S.—Mark Hurll, of Glasgow, Scotland, has been investigating the fireclay deposits in this district with a view to establishing a plant for making fire brick.

Lindsay, Ont.—A by-law submitted to the ratepayers to authorize payment of $65,000 to the Horn Brothers' Woollen Co. was carried here on June 24 by a majority of 311.

Weyburn, Sask.—E. R. Humphries, Regina manager for the Canadian Oil Companies, Ltd., was in town recently for the purpose of completing arrangements for locating a distributing station at this point.

Trade Gossip

Canadian Vickers, Ltd., Montreal, have sold a motor generator costing $5,400 to the city of Winnipeg, Man.

Heap & Partners, Canada, Ltd., Montreal, have been awarded a contract by the Ottawa city council for the supply and installation of a pump.

The Canadian Fairbanks-Morse Co., Toronto, have received a repeat order for an X-ray electric generator outfit for the Canadian Expeditionary Force.

The B. F. Sturtevant Co., of Canada, Ltd., Galt, Ont., have been awarded the contract for the heating and ventilating equipment for a new shop which the Canadian Locomotive Co. are building in Kingston, Ont.

The John Bertram & Sons Co., and its associate company, the Pratt & Whitney Co. of Canada, Ltd., announce change of Western office address to 1205 McArthur Building, Winnipeg. A. Martin is the Western representative.

Transcona, Man.—A notice has been issued to the effect that commencing today, July 1, 1915, the Dominion Government has taken over the operation of the Transcona shops, round-houses and work pertaining to this department between Winnipeg and Westfort.

Berlin, Ont.—A company has been formed with a capital of $100,000 to manufacture carburetors and vaporizers here. The patents are controlled by the Kerosene Burning Carburetor Co., of Detroit, Mich. Claude Forsyth of the John Forsyth Co., Berlin, is interested.

The Prince Rupert, B.C.—The Board of Trade published its annual report for 1914, together with general information as to the resources of the district of northern British Columbia. The report contains an interesting review of trade and commercial conditions at Prince Rupert, and indicates opportunities for industrial development.

Delay Shell Shipment.—Orders to delay shipment of any more shells for the present have been received by manufacturers, the instructions being that these should be held until further notice. While no information was given as to the reason for the order, it is felt that it is due to the shell cases being turned out more rapidly than they can be filled with explosives for shipment to England.

Dominion Steel Production.—The Dominion Steel Corporation production for the month of June, with comparisons, was as follows:

	1915, tons.	1914, tons.
Pig iron	22,552	21,111
Steel ingots	28,680	26,629
Rails	13,044	16,998
Rods	6,435	1,981
Bars	797	2,347
Wire and wire products	3,167	1,541
Coal mined	481,820	485,449

Customs Receipts Show Increase.—For the first time in a considerable period, Customs receipts for the month just closed, June, show an increase over the same period last year. This is an indication that the new war taxes are beginning to take effect. Customs receipts for June were $7,315,638.74, as compared with $7,274,763.32 in June, 1914, an increase of $40,875.42. For the three months ending June 30 the total Customs receipts were $20,907,939.88, or $772,530.66 less than during the corresponding period last year.

Halifax, N.S.—At a Board of Control meeting on June 30, the directors of the Nova Scotia Car Works, Ltd., asked the city for an additional $125,000, as further capital is declared by directors to be absolutely required to successfully carry on its business. The city originally advanced $125,000 and a portion of this loan has been paid off by instalments. The additional amount asked for will bring the company's liability to the city up to $250,000, and the amount will be secured by mortgage in same manner as previous advance.

Canadian Trade.—The possibilities of increased trade between Russia and Canada are now being seriously considered. Until a short time ago Canada did no business direct with Russia. In 1913, out of our $2,145,000 of exports to Russia no less than $2,017,000 passed through the United States. Similarly Russian products were brought to Canada in foreign ships. Now the Canadian Pacific Railway are establishing a line of steamers between Vancouver and Vladivostock, and it is expected that an increased and direct trade will be built up between the two countries.

Shell Shipping Boxes.—The Shell Committee, Stephen Building, Ottawa, have issued the following additional details in connection with the specifications for shell boxes. In reference to the screw used to secure the cover in the 4.5 shell box, we would say that you have the alternative of using No. 12 x 1¾ ins., or No. 14 x 1¾ ins., and that there is to be only one screw in each end and two in each side, suitably spaced. Further, the cleats on the cover are to be made ⅝-inch instead of ½-inch. Also, the lumber throughout the box may be dressed to an even thickness not less than ⅞-inch.

The Canadian Car & Foundry Co., Montreal, has received an order from the Railway Executive Committee of the British War Office for 1,200 four-wheel, continental type, 22-ton, steel frame box cars. The value of the order was placed at $1,200,000 by W. W. Butler, senior vice-president, who states that the cars will be manufactured at the company's local plants. Manufacturing operations will be started immediately. Mr. Butler explained that the cars were to be used in connection with military operations of the British army in northern France. The specifications of the equipment conformed in every respect to the standards of the French railways.

Canadian Car Co. Shell Contract.—It is understood that the loading of shrapnel and high explosive shells by the Canadian Car & Foundry Co. in its $83,000,000 contract with the Russian Government was not included in the original contract, but that it was arranged for later at the request of the Russian Government. Construction of the factory for assembling and loading of the shells near Lyndhurst, N.J., is not expected to be completed for about a month. No exports of shells by the Canadian Car Co. are looked for before the early part of August, although shipments of parts to assembling points by American manufacturers to whom the contract was sub-let will be well under way before then.

Large Equipment Orders.—Further equipment orders have been placed this week. The Federal Government has ordered 15 locomotives, to cost $22,000 each, from the Canadian Locomotive Co. of Kingston. An order has also been placed for 1,000 box cars for the National Transcontinental Railway. This contract has been placed among three concerns—the Canadian Car and Foundry Co., the National Steel Car Co., and the Nova Scotia Car Co. The Canadian Locomotive Co. is already working on a Russian Government order for 50 locomotives, while the Eastern Car Co. has an order for 2,000 cars also from the Russian Government. Canadian Car & Foundry Co. have a Dominion Govern-

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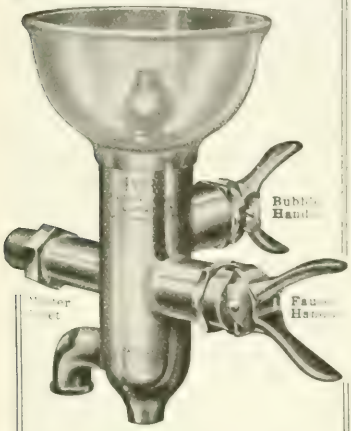
Saves Dollars



Puro Pays for Itself

"PURO-FY"
YOUR WATER SUPPLY
Puro Sanitary Drinking Fountain Company
147 University Ave., Toronto, Canada

TANKS — TANKS

IMMEDIATE SHIPMENT
Thoroughly overhauled. Guaranteed tight. Capacity 1,000 to 8,000 gallons.
UNIVERSAL IRON & SUPPLY CO.
ST. LOUIS, U.S.A.
Ask for Low Delivered Prices.

A WANT AD. IN THIS PAPER WILL BRING REPLIES FROM ALL PARTS OF CANADA.

...order for 600 standard freight cars for the Intercolonial Railway.

Canada's Metal Production. — Last year Canada produced metal and ...values were valued at $58,870,000. Copper contributed 77,000,000 pounds at an average price of 13½ cents, valued at $10,400,000 ounces, valued at $1,040,000; lead, 46,000,000 pounds at 4½ cents, nickel, 4,000,000 at 30 cents a pound, silver, 22,000,000 ounces at 48.8 cents, and the ore, 11,000 tons, valued at $330,000. The war has affected metals in various ways. Copper is now selling at 20 cents a pound, spelter about 30 cents a pound, while lead and zinc also show advances in price. The only exception to the general increase is silver, which is now selling about 5 cents an ounce less than last year. It is estimated, however, that the heavy demand for munitions means $20,000,000 to Canada's mine owners.

Tenders

Bathurst, N.B. — Tenders ... called for the construction of a power ..., concrete station, steel pipe, water mains, etc.

Winnipeg, Man.—Tenders addressed to ..., secretary, Board of Control, will be received up to Friday, July 16, 1915, for the supply of electrodes, glassware and ... for the City Light Department. Instructions to bidders, specifications and form of tender may be obtained at the office of the City Light & Power Department, 54 King street.

Ottawa, Ont.—Tenders for incandescent lamps for public buildings, will be received Tuesday, July 13, 1915. Specifications may be seen on application to Thos. A. Hastings, clerk of works, Postal Station "F," Toronto; to R. L. Deschamps, overseer, Dominion Buildings, Montreal, and to the chief architect, Department of Public Works, Ottawa.

Contracts Awarded

Walkerton, Ont.—The ... Furniture Co. has received an order for 25,000 boxes to load ...

Orillia, Ont.—The Orillia Furniture Co. have received an order to manufacture ... for the ... Co.

The Hamilton Bridge Works Co., Hamilton, Ont., have been awarded the contract for the construction of a ... steel ... for the ... Company.

Hespeler, Ont.—The Hespeler Furniture Co. and the W. A. Sparks Co. have received orders for shell and ammunition boxes. These orders will ...

Rumely-Wachs Machinery Co.
121 N. JEFFERSON ST.
CHICAGO ILLINOIS

New and second-hand machine tools in stock for immediate delivery:

LATHES

... (Used).
... C.R. H.S. (Used).
... C.R. H.S. (Used).
... C.R. H.S. (Used).
... C.R. H.S. (Used).
... (Used).
... (Used).
... (Used).
... (New).
... (Used).
... (Used).
... (Used).

TURRET LATHES and SCREW MACHINES

... hex. turret, on carriage (Used).
... (Used).
... (Used).

PLANERS

... (Used).
... (Used).
... Frog and Switch, two heads (Used).

SHAPERS

... (Used).
16" Stockbridge crank (Used).
... (Used).

DRILL PRESSES

... (Used).
... (Used).
22½" Barnes, b.g. power feed (Used).
... (Used).
... plete (Used).
28" Barnes, sliding head, complete.
... (Used).
... (Used).
... (Used).

MILLING MACHINES

... plain (Used).
... plain (Used).

MISCELLANEOUS

... 6" (Used).
... 5" (Used).
42" Colburn Boring Mill, 2 heads (Used).
42" Bullard Boring Mill, 2 heads (Used).
36" Bullard Boring Mill, one turret head (Used).
1¼" Acme Bolt Cutter (Used).
2½" Acme Bolt Cutter (Used).

PATENT ATTORNEYS

PATENTS
W. T. Cuffe-Quin
Patent Solicitor and Expert
Registered Patent Attorney, U.S. 9187
Fellow Surveyors Institute, London, England.
47 Central Chambers, Elgin Street,
OTTAWA, CANADA Near Govt. Patent Office
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Draw Cut Shapers, Special Draw Cut R.R Shapers, Special Locomotive Cylinder Planers.
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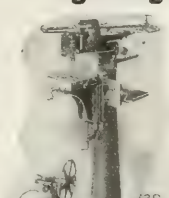
WRITE FOR DETAILS.
Geo Gorton Machine Co.
RACINE, WIS.

tate the installation of special machinery.

Transcona, Man.—At a special meeting of Town Council on June 29 the contract for the pumps for the sewage reservoir was awarded the British Canadian Engineering Co., at $3,174.34. It was decided to purchase 1,500 feet of fire hose from the Gutta Percha Co. at 80 cents per foot.

Personal

Peter H. Cowan has commenced his duties as waterworks superintendent of the City of Galt, Ont., succeeding Mr. Bartleman, who resigned.

J. C. Rockwell, manager of the Lunenburg Foundry Co., Lunenburg, N.S., died at that place on June 29. Mr. Rockwell, who was born in Cornwallis, N.S., 50 years ago, had been manager of the Lunenburg Foundry Co. since 1899.

Thomas Chater, for 26 years the chief engineer of the Windsor electric lighting plant, died on June 28, aged 60 years. The deceased was born in England, and came to Canada when he was 15 years old. He has lived in Windsor for more than forty years.

Harry F. Barnes, a member of the city engineer's department of London, Ont., has been given an important post in China and sails for that country on July 27 to become instructor of railroad engineering in the State University of Tang Shang, South China.

H. T. Matthew has been appointed Pacific Coast representative for the Society of Electrical Development, New York City. Mr. Matthew was born in St. John, N.B., in 1878, and entered the employ of the McGraw Publishing Co., New York, in 1901, with whom he is still associated.

D. A. Thomas, M.P., who has been appointed munitions agent in Canada and the United States for the British Government, arrived at New York on July 5, on the American liner St. Louis. He was met at the pier by Ambassador Sir Cecil Spring-Rice and Willard D. Strait of J. P. Morgan & Co.

Col. W. M. Davis, formerly city engineer at Woodstock, Ont., and Berlin, Ont., has been selected to command the 54th Kootenay Battalion, which is now being organized at Vernon, B.C. Col. Davis was born at Aylmer, Ont., and graduated from the R.M.C., Kingston, Ont.

Capt. L. A. Demers, Dominion Wreck Commissioner, has completed the investigation into the stranding of the steamship Romney on Greene Island recently. Judgment will be given in a few days. The ship is now in the dry dock at Quebec having some new plates put on the bottom and others rolled again.

Catalogues

Vises.—A leaflet describing and illustrating the all-steel machine vises made by the Cincinnati Milling Machine Co., Cincinnati, O., has come to hand.

Metal Saw Table.—A bulletin describing and illustrating the Acme Metal Saw Table No. 2, manufactured by the Hub Machine & Tool Co., Philadelphia, Pa., has been received. This machine is adapted for cutting sheet copper and brass, tubes, fibre, rubber and other materials.

Centrifugal Compressors for blast furnaces, is the title of bulletin No. 48601, just off the press, and being distributed by the Canadian General Electric Co., Toronto. The advantages claimed for this type of blower over the reciprocating blowing engine are described in detail and the illustrations give a general idea of the design. These latter are supplemented by a description of the compressor including, of course, its principal features and method of operation.

Power Transmission Appliances.—The new "Oneida" line of power transmission appliances is dealt with in bulletin 03, issued by the Oneida Steel Pulley Co., Oneida, N.Y. The principal lines described include drop and post hangers, pillow blocks, couplings, etc. Their principal features are dealt with in detail and price lists give the code words and other useful information for the various sizes of each appliance. The bulletin is fully illustrated.

Cold Storage Doors made by the Jamison Cold Storage Door Co., formerly the Jones Cold Store Door Co., Hagerstown, Md., are dealt with in catalogue No. 7 recently issued. The construction of the "Jones" and "Noequal" cold storage doors, fireproof and non-fireproof is fully described, and is accompanied by illustrations showing the details as designed for coolers and sharp freezers, etc. Particulars are given of cold storage windows, also of revolving and sliding doors. The catalogue contains 96 pages with thumb index and is gotten up in an attractive manner.

Chemical Control for FOUNDRY, CORE ROOM AND POWER PLANT
"Chemists to the Manufacturer"
THE TORONTO TESTING LABORATORY, LIMITED
Special Rates on Contract Work.
160 Bay Street, Toronto
UNEQUALLED SERVICE
Tests on Metals, Fuels, Oils, Water, Etc

ECONOMIC WATER OIL

SHELL MANUFACTURERS use ECONOMIC WATER OIL for MILLING, TURNING, DRILLING, TAPPING and REAMING.

IT SAVES TIME AND LABOR

WE CAN SAVE YOU 50 per cent. in COST of your CUTTING MIXTURE BILL.

ONE GALLON of ECONOMIC WATER OIL will make from 30 to 50 gallons of WATER mixture, according to quality of water and nature of work. Satisfactory and economic RESULTS

Our TRIAL ORDER will prove our STATEMENT

Made in Canada

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Keen Kutter Cutting Compound

is a most efficient lubricant for use on lathes, for drilling and cutting. It protects the tools, is very cooling, easily mixed with any separator, does not injure the hands, and is the best article on the market for the work. Being manufactured in Canada, we are thus able to save the user 20% in price. The quality we guarantee.

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is an oil specially prepared by us for the dipping of steel.

Write us to-day if you are in the market and we will be pleased to submit quotations.

The Commercial Oil Company Limited

Hamilton, Ontario

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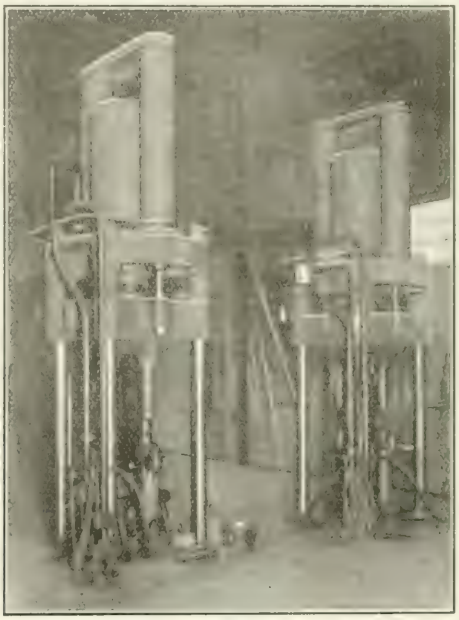
FOR

Shell Manufacturing



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TRADE MARK

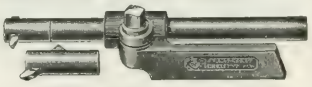
For Quick, Accurate Boring Use
ARMSTRONG BORING TOOLS

Bars may be extended from the Shank or Holder to any desired depth. Cutters are simply pieces of steel of stock size and shape. SAVES ALL FORGING AND NEARLY ALL TOOL STEEL.

Our complete line is on exhibition in Block 41, Palace of Machinery, Panama-Pacific Exposition, San Francisco.

1=12

One Armstrong Boring Tool will take the place of a dozen forged boring tools.



Catalog Sent for the Asking.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
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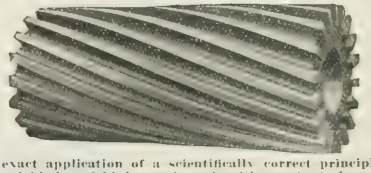
Taylor-Newbold Milling Cutters



The exact application of a scientifically correct principle—inserted blades of high-speed steel, with constant clearance and rake-angle throughout their length.
"Made by Tabor" means "Backed by Tabor."
Send for Bulletin R-P

THE TABOR MANUFACTURING COMPANY
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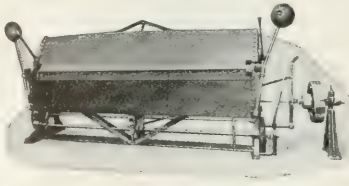
Chicago Steel Bending Brakes

We are exclusive Manufacturers of Steel Bending Brakes, and our product shows it.



10 ft. for 10 Ga.

Only about three horse-power is required to operate this brake full capacity.

Catalog giving full description mailed upon request.

The Steel Bending Brake Works, Ltd., Chatham, Ontario

ALLEN Safety Set Screws, any length, point or thread.

Send for circular No. 3 and free sample screws.

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[illegible] Hunt Wheel Co., Hamilton, Ont.
[illegible] Wheel Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
Norton Co., Worcester, Mass.
Stevens, F. B., Detroit, Mich.

Acetylene.
L'Air Liquide Society, Montreal, Toronto.

Acetylene Generators.
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Accumulators, Hydraulic.
[illegible] & Boomer, Toronto.
[illegible] Machine Co., Walkerville, Ont.
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Whiting Foundry Equipment Co., Harvey, Ill.

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Girard Machine & Tool Co., Philadelphia, Pa.
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F. W. Devo Co., Brooklyn, N.Y.
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Burring Reamers.
Wells Brothers Company, Greenfield, Mass.
Will Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Butterines.
Wells Brothers Company, Greenfield, Mass.

Burrs, Iron and Copper.
Parmenter & Bulloch Co., Gananoque
Cappers' Machinery.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
National Machinery & Supply Co., Hamilton, Ont.

Cars, Industrial.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Limited, Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Castings, Aluminum.
Cunningham & Son, St. Catharines, Ont.
Owen Sound Iron Works Co., Ltd., Owen Sound, Ont.
St. Lawrence Foundry, Galt, Ont.
Tallman Brass & Metal Co., Hamilton

Castings, Air Furnaces.
Wm. Tod Company, Youngstown, O.

Castings, Brass.
Cunningham & Son, St. Catharines, Ont.
Alexander Fleck, Ltd., Ottawa.
T. C. Lawrence Foundry, Galt, Ont.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O.

Castings, Bronze.
Cunningham & Son, St. Catharines, Ont.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O

Castings, Copper.
Cunningham & Son, St. Catharines, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Gray Iron.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Castings of Ottawa, Ottawa, Ont.
Erie Foundry Co., Erie, Pa.
Alexander Fleck, Ltd., Ottawa.
Gardner, Robt., & Son, Montreal.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.

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Electric Steel & Metals Co., Welland.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Wm. Tod Company, Youngstown, O.

Castings, Malleable.
Galt Malleable Iron Co., Galt.

Castings, Nickel Steel.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.

Cement, Disc Wheel.
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Cement, Iron.
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Cushman Chuck Co., Hartford, Conn.
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Girard Machine & Tool Co., Philadelphia, Pa.
Wells Brothers Co., Greenfield, Mass.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin, Brantford.
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Morse Twist Drill & Machine Co., New Bedford.
National Machinery & Supply Co., Hamilton.
Skinner Chuck Co., New Britain, Conn.
D. E. Whiton Machine Co., New London, Conn.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

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Chucks, Ring Wheel.
Gardner Machine Co., Beloit, Wis.

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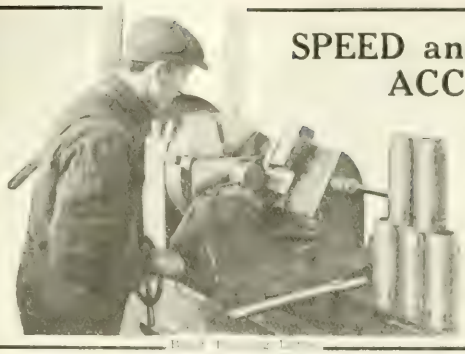

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New Britain Machine Co., New Britain, Conn.
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Pratt & Whitney Co., Dundas, Ont.
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Jones & Glassco, Montreal, P.Q.
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A. R. Williams Machy. Co., Toronto.

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Meters, Electrical.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Mill Machinery.
Cunningham & Sons, St Catharines, Ont.
Alexander Fleck, Ltd., Ottawa.

Milling Attachments.
John Bertram & Sons Co., Dundas.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Cincinnati.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co. Milwaukee, W.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Horizontal and Vertical.
A. R. Williams Machy. Co., Toronto.
Brown & Sharpe Mfg. Co., Providence.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
Gooley & Edlund, Cortland, N.Y.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee, W.
Motch & Merryweather Machy. Co., Cleveland, O.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Crescent Oil Co., New York
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Keyseat.
Newton Machine Tool Works, Philadelphia, Pa.

Milling Machines, Multiple Spindle, Duplex, Etc.
Newton Machine Tool Works, Philadelphia, Pa.

Milling Machines, Plain, Bench and Universal.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Milling Machine Co., Cincinnati.
Garvin Machine Co., New York.
Gooley & Edlund, Cortland, N.Y.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Hendey Machine Co., Torrington.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee, Wis.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
A. R. Williams Machy. Co., Toronto.

Milling Machines, Profile.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

Milling Tools.
Brown & Sharpe Mfg. Co., Providence.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, W.

Mine Cars and Hitchings.
Pratt & Whitney Co., Dundas, Ont.
Modern Tool Co., Erie, Pa.
Can. Fairbanks-Morse Co., Montreal.

Mining Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Mortising Machines.
Jones & Glassco, Montreal.

Motors, Electric.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Motors, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Multiple Index Centres.
Garvin Machine Co., New York.

Nipple Threading Machines.
John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.

Nitrogen.
L'Air Liquide Society, Montreal, Toronto.

Nozzles, Spray.
Can. Buffalo Forge Co., Montreal.

Nuts, Semi-Finish and Finished.
Galt Machine Screw Co., Galt, Ont.
John Morrow Screw Co., Ingersoll Ont.

Nut Burring Machines.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Machines (Hot).
National Machy. Co., Tiffin, O.

Nut Facing and Bolt Shaving Machines.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Tappers.
John Bertram & Sons Co., Dundas.
Garvin Machine Co., New York.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Hall, J. H., & Son, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Wrenches.
Wells Brothers Co., Greenfield, Mass.

Oil Separators.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Smart-Turner Machine Co., Hamilton, Ont.

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Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

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Commercial Oil Co., Hamilton, Ont.

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Geo. Gorton Machine Co., Racine, Wis.
The Oven Equipment & Supply Co., New Haven, Conn.
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Oscillating Valve Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

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L'Air Liquide Society, Montreal, Toronto.

Oxygen.
L'Air Liquide Society, Montreal, Toronto.

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Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Montreal.

Packing, Rubber, etc.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Pans, Lathe.
Cleveland Wire Spring Co., Cleveland

Pans, Steel Shop.
Cleveland Wire Spring Co., Cleveland

Paper Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.
Can. Sirocco Co., Ltd., Windsor, Ont.

Partitions.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Patent Solicitors.
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Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.
Ross Thomson & Co., Ottawa, Ont.

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Galt Malleable Iron Co., Galt.
Guelph Pattern Works, Guelph.
Hamilton Pattern & Foundry Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound, Ont.
Plessisville Foundry, Plessisville, Que.
Toronto Pattern Works, Toronto.
Wells Pattern & Machine Works, Toronto.

Patterns, Metal and Wood.
Guelph Pattern Works, Guelph, Ont.

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Canada Wire & Iron Goods Co., Hamilton.

Penstocks.
Dodds Iron Works, Toronto.

Phosphor Bronze Castings.
Tallman Brass & Metal Co., Hamilton.

Pig Iron.
Hanna & Co., M. A., Cleveland, O.
Stevens, F. B., Detroit, Mich.

Pinions, Mill Cut.
Wm. Tod Co., Youngstown, O.

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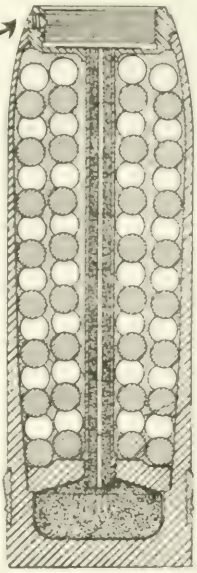
AND FUSES



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We have screws for other uses. Let us acquaint you with our product.

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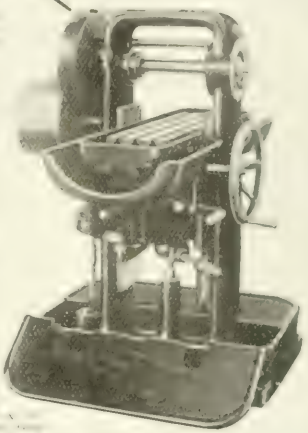

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At a certain point in its life on *any* work, a File's *best efficiency* is lost.

Beyond that point it's a "time-killer." The extra time it wastes would pay for *several* new files.

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Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Triment Mfg. Co., Roxbury, Mass.
Williams Tool Co., Erie, Pa.

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Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
John H. Hall & Sons, Ltd., Brantford, Ont.

Pipe Straightening Machines.
Watson-Stillman Co., Aldene, N.J.

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Lancashire Dynamo & Motor Co., Ltd., Toronto.
Niles-Bement-Pond Co., New York.

Planer Jacks.
Armstrong Bros. Tool Co., Chicago.

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Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

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Fay & Scott, Dexter, Maine.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.

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Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

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Canadian Billings & Spencer, Ltd., Welland.
McKaig Drop Forge Co., Buffalo, N.Y.

Pneumatic Tools.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Independent Pneumatic Tool Co, Chicago, New York.

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New Britain Machine Co., New Britain, Conn.

Portable Steel Tool Racks.
New Britain Machine Co., New Britain, Conn.

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New Britain Machine Co., New Britain, Conn.

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Hooper-Falkenau Eng. Co., New York.

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The Smart-Turner Mach. Co., Hamilton.

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W. F. & John Barnes Co., Rockford.

Presses, Bench Straightening.
Toledo Machine & Tool Co., Toledo.

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Can. Locomotive Co., Kingston, Ont.
Wm. Tramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
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Goldie & McCulloch Co., Galt, Ont.
Watson-Stillman Co., Aldene, N.J.
West Tire Setter Co., Rochester, N.Y.
R. D. Wood Co., Philadelphia, Pa.

Presses, Cam, Toggle, Eyelet.
Baird Machine Co., Bridgeport, Conn.
Toledo Machine & Tool Co., Toledo, O.

Presses, Broaching.
E. W. Bliss Co., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman & Co., Aldene, N.J.

Presses, Drop.
W. H. Banfield & Son, Toronto.
E. W. Bliss Co. Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Boomer & Boschert Press Co., Montreal.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.

Presses, Filter.
Lymburner, Ltd., Montreal.

Presses, Forging.
Can. Boomer & Boschert Press Co., Montreal.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
Charles F. Elmes Eng. Works, Chicago, Ill.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Wm. Tod Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.

Presses, Hydraulic.
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Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Charles F. Elmes Eng. Works, Chicago, Ill.
Hydraulic Press Co., Mt. Gilead.
Niles-Bement-Pond Co., New York.
Wm. Tod Company, Youngstown, O
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.
R. D. Wood Co., Philadelphia, Pa.

Presses, Pneumatic.
Toledo Machine & Tool Co., Toledo.

Presses, Power.
Baird Machine Co., Bridgeport, Conn.
Can. Boomer & Boschert Press Co., Montreal.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Can. Fairbanks-Morse Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Geo. Gorton Machine Co., Racine.
Girard Machine & Tool Co., Philadelphia, Pa.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.
A. R. Williams Machy. Co., Toronto.

Presses, Scrap Baling.
Can. Boomer & Boschert Press Co., Montreal.
Watson-Stillman Co., Aldene, N.J.

Presses, Spring Foot.
Baird Machine Co., Bridgeport, Conn.
Toledo Machine & Tool Co., Toledo.
Brown, Boggs & Co., Hamilton, Can.

Presses, Screw.
Can. Boomer & Boschert Press Co., Montreal.

Pressure Regulators.
Can. Fairbanks-Morse Co., Montreal.

Protective Paint.
Jos. Dixon Crucible Co., Jersey City.

Pulleys.
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Positive Clutch & Pulley Works, Ltd., Toronto.
The Smart-Turner Mach. Co., Hamilton.

Pulley Machinery, Drilling and Tapping.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.

Pumps, High Pressure.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Pumping Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
The Smart-Turner Mach. Co., Hamilton.
Wm. Tod Company, Youngstown, O.

Pumps, all Kinds.
Can. Buffalo Forge Co., Montreal.
Charles F. Elmes Eng. Works Chicago
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
Owen Sound Iron Works Co., Owen Sound.
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A. R. Williams Machy. Co., Toronto.
Watson-Stillman Co., Aldene, N.J.
Wayne Oil Tank & Pump Co., Fort Wayne.

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D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
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Pumps, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Wm. Tod Co., Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Pumps, Steam.
Wm. Tod Company, Youngstown, O.

Pump Leathers.
Graton & Knight Mfg. Co., Montreal.

Punches and Dies.
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E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Scott Bros., Halifax, Eng.
Gardner, Robt., & Son, Montreal.
Globe Machine & Stamping Co.
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Pratt & Whitney Co., Dundas, Ont.
Toledo Machine & Tool Co., Toledo, O.
A. O. Walworth & Co., Chicago, Ill.

Punches, Power.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Girard Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.
A. O. Walworth & Co., Chicago, Ill.

Punches, Pneumatic.
Jno. F. Allen Co., New York.

Punching Machines, Horizontal.
Bertrams, Ltd., Edinburgh, Scotland.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Long & Alstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.

Pyrometers.
Brown Instrument Co., Philadelphia, Pa.
Canadian Hoskins, Limited, Walkerville, Ont.
Shore Instrument & Mfg. Co., New York City.
Thwing Instrument Co., Philadelphia, Pa.

Quartering Machines.
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

Ratchet Wrenches.
Wells Brothers Co., Greenfield, Mass.

Railing, Iron and Brass.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada

Rail Benders.
Niles-Bement-Pond Co., New York.

Railroad Tools.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.

Railroad Tools, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Rammers, Bench and Floor.
Guelph Pattern Works, Guelph, Ont.

Rapping Plates.
Stevens, F. B., Detroit, Mich.

Ratchets.
Keystone Mfg. Co., Buffalo, N.Y.

Raw Hide Pinions.
Chicago Rawhide Mfg. Co., Chicago, Ill.
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Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Smart-Turner Machine Co., Hamilton, Ont.

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Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wells Brothers Co., Greenfield, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

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Butterfield & Co., Rock Island, Que.
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Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
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Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Reamer Fluting Machines.
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Reamers, Pipe, Cylinder and Locomotive.
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Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford.
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Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

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Baird Machine Co. Bridgeport, Conn.
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Independent Pneumatic Tool Co. of Chicago, Ill.
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Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.

Riveting Machines, Elastic Rotary Blow.
Girard Machine & Tool Co., Philadelphia, Pa.
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Toledo Machine & Tool Co., Toledo.

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Toronto and Hamilton Electric Co., Hamilton.

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Can. H. W. Johns-Manville Co., Ltd., Toronto.

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James Chesterman & Co., Ltd., Sheffield, Eng.
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W. W. Sly Mfg. Co., Cleveland, O.

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Hub Machine Welding & Contracting Co., Philadelphia, Pa.

Saw Sharpening Machines.
Nutter & Barnes Co., Hinsdale, N.H.

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Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt. & Son, Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Espen-Lucas Machine Works, Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
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Sawing Machines, Cold Metal.
Newton Machine Tool Works, Philadelphia, Pa.

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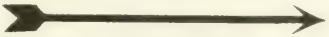

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Espen-Lucas Machine Works, Philadelphia, Pa.
Huther Bros. Saw Mfg. Co., Rochester, N.Y.
Q. M. S. Co., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.

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Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Works, Buffalo.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
L. S. Starrett Co., Athol, Mass.

Saws, Circular Metal.
Earle Gear & Machine Co., Philadelphia, Pa.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hub Machine Welding & Contracting Co., Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburg, Pa
Huther Bros. Saw Mfg. Co., Rochester, N.Y.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hot and Cold.
Earle Gear & Machine Co., Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburg, Pa.
Huther Bros. Saw Mfg. Co., Rochester, N.Y.
Nutter & Barnes Co., Hinsdale, N.H.
Q. M. S. Co., Chicago, Ill.
Vulcan Eng. Sales Co., Chicago, Ill.

Scleroscopes.
Shore Instrument & Mfg. Co., New York City.

Screws, Caps and Set.
Galt Machine Screw Co., Galt, Ont.
John Morrow Screw Co., Ingersoll, Ont.

Screw Machine Products.
Galt Machine Screw Co., Galt, Ont
John Morrow Screw Co., Ingersoll, Ont.

Screw Machines, Hand, Automatic.
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
A. B. Jardine & Co., Hespeler.
Motch & Merryweather Machy. Co., Cleveland, O.
National Mach. & Sup. Co., Hamilton.
New Britain Machine Co., New Britain, Conn.
Pratt & Whitney Co., Dundas, Ont.
A. O. Walworth & Co., Chicago, Ill
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto
Windsor Machine Co., Windsor, Vt.

Screw Machines, Multiple Spindle.
New Britain Machine Co., New Britain, Conn.
Windsor Machine Co., Windsor, Vt.

Screw Plates.
Butterfield & Co., Rock Island, Que.
Can. Tap & Die Co., Galt, Ont.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford
Wells Brothers Co., Greenfield, Mass.
Wiley & Russell Co., Greenfield, Mass.

Screw Slotters.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Set Screws, Safety.
Allen Mfg. Co., Hartford, Conn.

Second-Hand Machinery.
New York Machinery Co., New York.
Gaspiner, Robt., & Son, Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Gaspiner, Robt., & Son, Montreal
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
Pleasantville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.
Union Drawn Steel Co., Hamilton.

Shanks, Straight and Taper.
Jacobs Mfg. Co., Hartford, Conn.

Shapers.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
W. P. Davis Machine Co., Rochester, N.Y.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Hendey Machine Co., Torrington, Ct.
Hill, Clarke & Co., of Chicago, Chicago, Ill.

Shafting.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Stockbridge Machine Co., Worcester, Mass.

Sharpening Stones.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

Shavings, Separators.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Shearing Machines, Angle Iron, Bar and Gate.
John Bertram & Sons Co., Dundas.
Bertrams, Ltd., Edinburgh, Scotland.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler.
Long & Alstatter, Hamilton, Ohio.
Niles Bement-Pond Co., New York.
Scott Bros., Halifax, Eng.
Toledo Machine & Tool Co., Toledo.

Shears, Power.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown Boggs Co., Ltd., Hamilton, Canada.
Buffalo Forge Co., Buffalo, N.Y.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machy. Co., Tiffin, Ohio.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
Scott Bros., Halifax, Eng.
Toledo Machine & Tool Co., Toledo.

Shears, Lever, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Shears, Pneumatic.
John F. Allen Co., New York.
Toledo Machine & Tool Co., Toledo, Ohio.

Shears, Squaring.
Brown, Boggs, & Co., Hamilton, Can.

Sheet Steel.
Dom. Sheet Metal Co., Hamilton, Ont.

Sheet Metal Working Tools.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Steel Bending Brake Works, Ltd., Chatham, Ont
Sheet Metal Stampings.
Duncan Electrical Co., Montreal.

Shell Banding Machines, Hydraulic.
Can. Locomotive Co., Kingston, Ont.
Symburner, Ltd., Montreal.
Motch & Merryweather Machy. Co., Cleveland, O.
Watson-Stillman Co., Aldene, N.J.
West Tire Setter Co., Rochester, N.Y.

Shell Painting Machine.
Can. Locomotive Co., Kingston, Ont.

Shell Screws, Headless.
Blake & Johnson, Waterbury, Conn.

Shelving, Steel Partitions.
Canadian Steel Products Company, Montreal.

Shrapnel Shell Forging, Drilling Machines.
Barnes Drill Co., Rockford, Ill.

Shrapnel Shell Marker.
Brown-Boggs Co., Hamilton, Ont.
Holden-Morgan Co., Toronto.
Noble & Westbrook Mfg. Co., Hartford, Conn.
Pangborn Corporation, Hagerstown, Md.

Shrapnel Sand Blasts.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, O.

Side Tools.
Armstrong Bros. Tool Co., Chicago.

Slotters.
Garvin Machine Co., New York.
Niles-Pement-Pond Co., New York.

Smokestacks.
Plessisville Foundry, Plessisville, Que.
Polson Iron Works, Toronto.

Sockets.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Soldering Irons.
Brown, Boggs & Co., Hamilton, Can.

Solders.
Tallman Brass & Metal Co., Hamilton.

Special Machinery.
Armstrong Bros., Toronto.
W. H. Banfield & Sons, Toronto.
John Bertram & Sons Co., Dundas.
Baird Machine Co., Bridgeport, Conn
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Can. Fairbanks-Morse Co., Montreal.
Canada Machy. Agency, Montreal.
Cunningham & Sons, St. Catharines, Ont.
Charles F. Elmes Eng. Works, Chicago
Detrick & Harvey Machine Co., Baltimore, Md.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
Jardine, A. B., & Co., Hespeler.
National Mach. & Sup. Co., Hamilton.
Plessisville Foundry, Plessisville, Que.
Smart-Turner Machine Co., Hamilton, Ont.
Wm. Tod Company, Youngstown, O

Spike Machines.
The Smart-Turner Machine Co., Hamilton.

Spring Coilers.
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

Springs, Machinery.
Cleveland Wire Spring Co., Cleveland.
Jas. Steele, Ltd., Guelph, Ont.

Spring Making Machinery (Automatic).
Baird Machine Co., Bridgeport, Conn.

Sprockets, Chain.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.

Stairs, Iron.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd. London, Canada.

Stamping.
Duncan Electrical Co., Montreal.

Stamping Machinery.
Horner & Wilson, Hamilton, Ont.
Brown, Boggs & Co., Hamilton, Can.

Stay-Bolt Driver.
Independent Pneumatic Tool Co., Chicago.

Stand Pipes.
Polson Iron Works, Toronto.

Stationary Ladders.
New Britain Machine Co., New Britain, Conn.

Steam Specialties.
Sheldons, Ltd., Galt, Ont.

Steam Separators and Traps.
Can. Fairbanks-Morse Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Steel Alloy.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

Steel Chains for Pulp Mill and Saw Mill.
Plessisville Foundry, Plessisville, Que.

Steel Bench Legs.
New Britain Machine Co., New Britain, Conn.

Steel Bending Brakes.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Steel, Cold Rolled.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel Pressure Blowers.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Steel, all kinds.
Can. Bridge Co., Walkerville, Ont.

Steel, High Speed.
Armstrong Whitworth of Canada Ltd., Montreal.
Can. Fairbanks-Morse Co., Montreal.
H. A. Drury Co., Ltd., Montreal.
Thos. Firth & Sons, Montreal.
National Mach. & Sup. Co., Hamilton
Vanadium Alloys Steel Co., Pittsburg, Pa.

Steel Die Engraving.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Steel Vanadium.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

Stocks for Dies.
Wells Bros. Co., Greenfield, Mass.

Stocks, Pipe.
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corporation, Greenfield, Mass.

Stools, Steel, Shop.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Stock Racks for Bars, Piping, Etc.
New Britain Machine Co., New Britain, Conn.

Straight Edges.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Straightening Machinery.
Baird Machine Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland
National Mach. & Sup. Co., Hamilton.

Structural Steel.
Hamilton Bridge Works Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound, Ont.

Studs.
Galt Machine Screw Co., Galt, Ont.
John Morrow Screw Co., Ingersoll, Ont.

Stud Driver.
Keystone Mfg. Co., Buffalo, N.Y.

Switchboards.
Toronto & Hamilton Electric Co., Hamilton.

Switches, Railway.
National Mach. & Sup. Co., Hamilton.

Tachometers.
Brown Instrument Co., Philadelphia, Pa.

Tanks, Oil.
Wayne Oil Tank & Pump Co., Fort Wayne, Ind.

Tanks, Steel.
John Inglis Co., Toronto.
Plessisville Foundry, Plessisville, Que
Polson Iron Works, Toronto.

Tapes, Measuring.
Lufkin Rule Co., Windsor, Ont.
James Chesterman & Co., Ltd., Sheffield, Eng.

Tapes, Friction.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Tapping Machines (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Tapping Machines and Attachments.
Baker Brothers, Toledo, O.
John Bertram & Sons Co., Dundas.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven
Girard Machine & Tool Co., Philadelphia, Pa.
Greenfield Tap & Die Corporation, Greenfield, Mass.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit
Niles-Bement-Pond Co., New York.
L. S. Starrett Co., Athol, Mass.

Tap Chucks.
Wells Bros., Greenfield, Mass.

Taps, Adjustable.
Geometric Tool Co., New Haven.
Manufacturers Equipment Co., Chicago, Ill.
Murchey Machine & Tool Co., Detroit.

Taps, Dies and Wrenches.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. Tap & Die Co., Galt, Ont.
Cleveland Twist Drill Co., Cleveland.
Geometric Tool Co., New Haven, Conn.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
L. S. Starrett Co., Athol, Mass.
Wiley & Russell Co., Greenfield, Mass.
Wells Brothers Co., Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Technical Books.
The MacLean Publishing Co., Ltd., Toronto.

Testing Instruments, Metallurgical.
Shore Instrument & Mfg. Co., New York City.

Testing Laboratories.
Toronto Testing Laboratory, Toronto.

Thread Cutting Machines.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Geometric Tool Co., New Haven, Conn.
Girard Machine & Tool Co., Philadelphia, Pa.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
National Machy. Co., Tiffin, Ohio.
Wiley & Russell Co., Greenfield, Mass.

Thread Milling Machines.
Holden-Morgan Co., Toronto.

Thermometers, Indicating and Recording.
Brown Instrument Co., Philadelphia, Pa.

Time Clocks.
International Time Recording Co. Toronto.

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If what you want is not advertised on these pages consult the Buyers' Directory at the back.

Tinsmiths' Tools.
Brown, Boggs & Co., Hamilton, Can.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Tire Setting Machines, Hydraulic.
West Tire Setter Co., Rochester, N.Y.

Tire, Wheels.
Wells Bros. Co., Greenfield, Mass.

Toolmakers' Files.
American Swiss File & Tool Co., New York.

Tool Boxes, Steel.
Can. Steel Products Co., Montreal.

Tool Holders.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Tool Room Partitions.
Can. Wire & Iron Goods Co., Hamilton.

Tool Posts, Lathe.
Armstrong Bros. Tool Co., Chicago.

Tool Steel.
Armstrong, Whitworth, Ltd., of Canada, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Thos. Firth & Sons, Montreal.
National Mach. & Sup. Co., Hamilton.

Tools, Blacksmiths', Etc.
A. R. Williams Machy. Co., Toronto.

Tools, Electrical.
A. R. Williams Machy. Co., Toronto.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
United States Elec. Tool Co., Cincinnati, O.

Tools, Grinding, Milling, Drilling, Etc.
Newton Machine Tool Works, Inc., Philadelphia, Pa.

Tools, Lathe, Planer and Slotter.
Armstrong Bros. Tool Co., Chicago.

Torches, Steel.
Stevens, F. B., Detroit, Mich.
Armstrong, Whitworth of Canada, Ltd., Montreal.

Track Bits.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Track Systems.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Track Tools.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.

Transformers and Converters.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Transmission Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Hamilton Gear & Mach. Co., Toronto.
Jones & Glasco, Montreal.
D. K. McLaren, Montreal.
Morse Chain Co., Ithaca, N.Y.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.

Transmission Towers.
Can. Bridge Co., Walkerville, Ont.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

Traveling Cranes.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Trolley Hoists, Electric.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Trucks, Lumber and Kiln.
Sheldons, Ltd., Galt, Ont.
Northern Crane Works, Walkerville.

Trucks, Factory, Freight, Etc.
Chambers, Ltd., Toronto.
Chapman Double Ball Bearing Co., Toronto.
Toronto Type Foundry Co., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

Tube Expanders (Rollers).
A. B. Jardine & Co., Hespeler.
Watson-Stillman Co., Aldene, N.J.

Tumbling Barrels.
Baird Machine Co., Bridgeport, Conn.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Turnbuckles.
Canadian Billings & Spencer, Ltd., Welland.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Turret Machines.
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R.I.
W. P. Davis Machine Co., Rochester, N.Y.
Fay & Scott, Dexter, Me.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.

Valves, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Watson-Stillman Co., Aldene, N.J.
R. D. Wood & Co., Philadelphia, Pa.

Valve Leathers.
Graton & Knight Mfg. Co., Montreal.

Valves, Back Pressure, Steam.
Sheldons, Limited, Galt.

Vanadium Steel.
H. A. Drury Co., Ltd., Montreal.

Ventilating Apparatus.
Can. Sirocco Co., Ltd., Windsor, Ont.
Pangborn Corporation, Hagerstown, Md.
Sheldons, Limited, Galt.
A. R. Williams Machy. Co., Toronto.

Vises, Bench.
Emmert Mfg. Co., Waynesboro, Pa.
Hollands Mfg. Co., Erie, Pa.

WHEN you need new equipment or supplies for your machine shop

Consult this Directory

¶ You'll find listed here the reliable makers of the lines you need; firms who believe in the progressiveness of present-day manufacturers and who appeal to their intelligence through their own engineering journal.

¶ Consult Canadian Machinery Buyers' Directory and you can't go wrong in your buying.

New Britain Machine Co., New Britain, Conn.
Pratt & Whitney, Hartford, Conn.
Turner Machine Co., Ltd., Danbury, Conn.
Warner & Swasey, Cleveland, O.

Turbines, Steam, Water.
Plessisville Foundry, Plessisville, Que.

Upsetting and Bending Machinery.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton, Canada.
A. B. Jardine & Co., Hespeler.
National Machy. Co., Tiffin, O.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.

Vacuum Pumps.
Buffalo Forge Co., Buffalo, N.Y.
Smart-Turner Machine Co., Hamilton, Ont.

Valve Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

National Mach. & Sup. Co., Hamilton.
New Britain Machine Co., New Britain, Conn.

Vises, Pipe.
Armstrong Mfg. Company, Bridgeport, Conn.
Bignall & Keeler Mach. Works, Edwardsville, Ill.
Butterfield & Co., Rock Island, Que.
Emmert Mfg. Co., Waynesboro, Pa.
National Mach. & Sup. Co., Hamilton.
J. H. Williams Co., Brooklyn, N.Y.

Vises, Planer and Shaper.
Girard Machine & Tool Co., Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
Skinner Chuck Co., New Britain, C.

Vises, Milling Machine.
National Mach. & Sup. Co., Hamilton.

Vises, Woodworking.
Emmert Mfg. Co., Waynesboro, Pa.

Voltmeters.
Brown Instrument Co., Philadelphia, Pa.

Washers.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
London Bolt & Hinge Works, London, Ont.

Washer Machines.
National Machy. Co., Tiffin, Ohio.

Waterproof Coating, Cement, Fabric.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Watchman's Clocks.
A. R. Williams Machy. Co., Toronto.

Wattmeters.
Brown Instrument Co., Philadelphia, Pa.

Welding and Cutting Clamps.
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.

Welding and Cutting Work.
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.
Metals Welding Co., Cleveland, O.

Welding, Autogenous.
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.

Welding, Acetylene and Oxygen
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.
Metals Welding Co., Cleveland, O.

Welding Machines, Electric, etc
Can. Blaugas Co., Ltd., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.

Wheels, Emery, Carborundum.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Toronto.

Winches.
John H. Hall & Sons, Brantford.
Northern Crane Works, Walkerville.

Window Wire Guards.
Canada Wire & Iron Goods Co., Hamilton.

Wire Cloth and Perforated Metals.
Canada Wire & Iron Goods Co., Hamilton.
Dennis Wire & Iron Works Co., Ltd., London.

Wire Forming and Stamping Machinery.
Brown, Boggs Co., Ltd., Hamilton, Canada.
F. B. Shuster Co., New Haven, Conn.
Baird Machine Co., Bridgeport, Conn.

Wire Guards and Railings.
Canada Wire & Iron Goods Co., Hamilton, Ont.

Wire Nails.
Parmenter & Bulloch Co., Gananoque.

Wire Nail Machinery.
National Machy. Co., Tiffin, Ohio.
A. R. Williams Machy. Co., Toronto.

Wire Straighteners and Cutters.
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Canada.
F. B. Shuster Co., New Haven, Conn.

Wire Coiling and Pointing Machines.
Baird Machine Co., Bridgeport, Conn.
F. B. Shuster Co., New Haven, Conn.

Wood Boring Machines.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Girard Machine & Tool Co., Philadelphia, Pa.
Independent Pneumatic Tool Co., Chicago, Ill.

Woodworking Machinery.
Buffalo Forge Co., Buffalo, N.Y.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
New Britain Machine Co., New Britain, Conn.
Plessisville Foundry, Plessisville, Que.
A. R. Williams Machy. Co., Toronto.

Wrenches.
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Rock Island, Que.
Canadian Billings & Spencer, Ltd., Welland.
Keystone Mfg. Co., Buffalo, N.Y.
Wells Bros. Co., Greenfield, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Wrenches, Automobile Narrow Jaw and Monkey.
Bemis & Call Hardware & Tool Co, Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Pipe, Monkey.
Bemis & Call Hardware & Tool Co Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Ratchet and Basin.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Keystone Mfg. Co., Buffalo, N.Y.
Trimont Mfg. Co., Roxbury, Mass.

No, Stevens' Stopper won't stop a train, but it will stop the blow hole in a defective casting so that you cannot find it.

In this way, it helps your bank account. The casting that otherwise would have to go to the scrap heap can be converted into good coin of the realm.

Same color as the rest of the casting. Doesn't look like a blue patch on Casey's faded overalls.

How to use Stevens' Stopper, or Circle Cement:

Stevens' Stopper is a fine powder, used with a little water and made into a paste—the hole is easily filled with a putty knife or trowel. It takes anywhere from two to twenty-four hours, depending upon the size of the patch, for the filler to become as hard as the casting itself. When rubbed with a file it shows the color of the casting, hence it is the best filler and the one thing that saves your castings, and that means the saving of your dollars.

Another thing—I do not ask a fancy price for it.

A pound will save many dollars' worth of castings. Put up in 5-lb., 10-lb., and 25-lb. cans.

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Have You a Buyer's Power ?

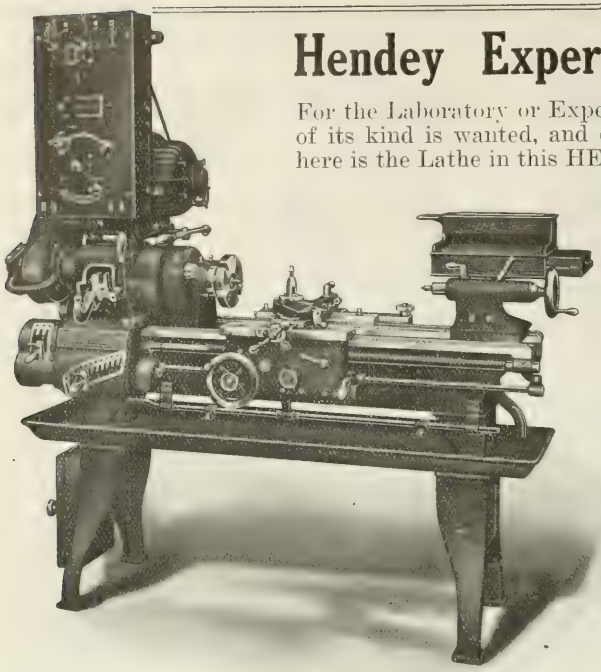
HALF a dozen pages from the back of "Canadian Machinery" you will find a Buyers' Directory. This is arranged alphabetically according to the name of the machine. Below each item is given a list of the most reliable makers.

¶ If you want a Drill or a Lathe, a Milling Machine or a Motor, a Reamer or a Riveter, a Planer or a Punch, or any kind of machine or piece of equipment, all you have to do to bring the best makers to your desk is to consult the Buyers' Directory in "Canadian Machinery."

¶ Here is to be found a list of the most dependable manufacturers. It is a universal catalog of all your needs and a ready reference guide to good buying. It is an Honor Roll of Progressive Machinery Makers. It is a brain-saver and a reputation builder for purchasing agents—a time-saver and a money-maker for men who do their own buying.

¶ Take a careful inventory of your present and possible requirements. Note what machines or supplies you will have to purchase in the near future. Consult Machinery's Buyers' Directory and write for the catalogs and the literature of the firms who are in a position to supply you. Get loaded for emergencies. Fill up on information. Decide before you have to who can best meet your requirements.

If what you want is not advertised in this issue consult the Buyers' Directory at the back.



Hendey Experimental 12" Lathe

For the Laboratory or Experimental Department where the best of its kind is wanted, and each machine must be motor-driven, here is the Lathe in this HENDEY 12".

In addition to its complete regular equipment it has Small Tool Cabinet for operators' fine tools, also gear closet for extra gears to cut special threads.

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Torrington, Conn., U.S.A.

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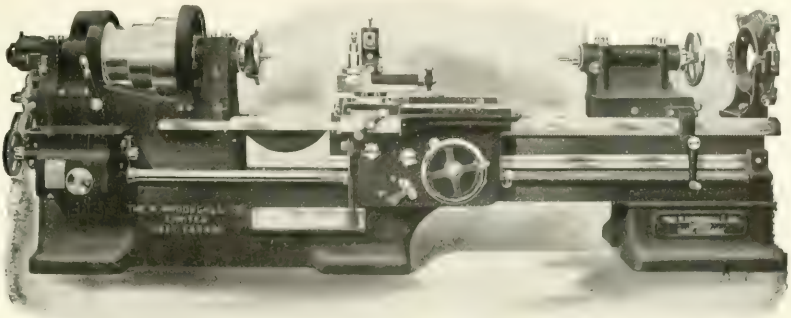
McDougall Gap Lathes

—

Strength
Accuracy
Quality



Take a look at the next money you intend to invest in a Lathe.
Then, take a look at the money's worth we offer you in our machine.
Your money will soon come back to you in increased production and we will have the pleasure of having a satisfied user. Our machines are just as good as they look and they look good too.
We invite the closest inspection.

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GALT, Ont., Canada
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For shell work this style of gage is most efficient and economical.

PROMPT SHIPMENT.

We maintain a large stock at all times.

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For every form and style of screw thread.

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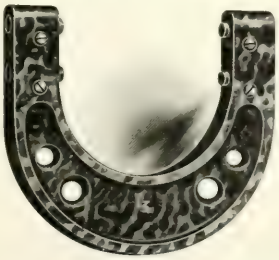

The upper points are set in maximum limits — the lower points to minimum limits. Points can be sealed to prevent tampering.

Wells Brothers Company of Canada, Limited

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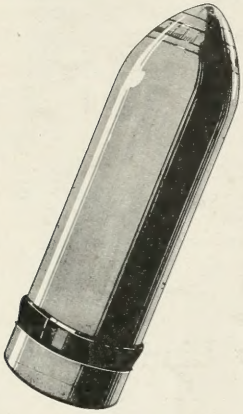
THE Gilbert & Barker



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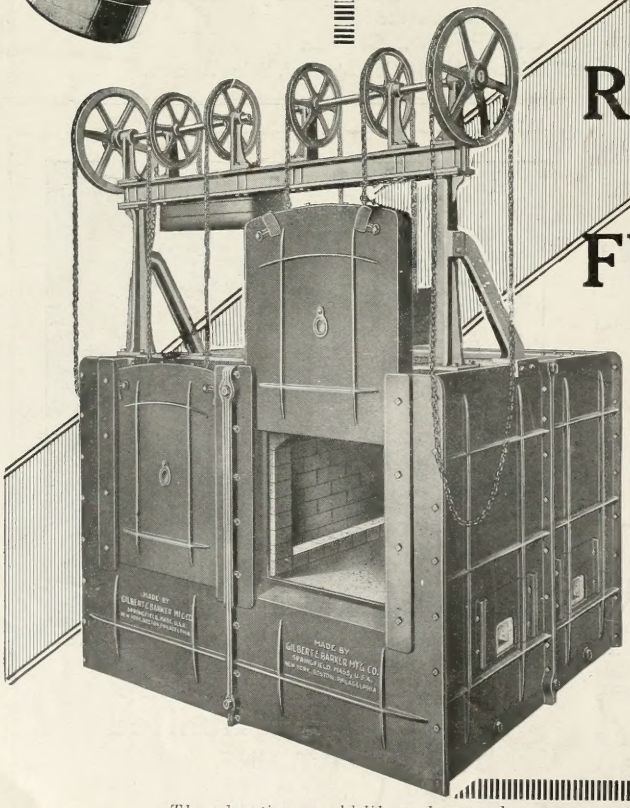
FOR

Annealing, Drawing, Nosing and General Heat Treatment of Shrapnel Shells and Heavy Projectiles, Military Rifles, and Cartridge Cases.



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Forge and
Blacksmith Shop
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Our semi-muffle oven furnaces produce a uniform temperature throughout the heating chambers, always under the instant control of the operator. There is no danger of over-heating the work. That's why our furnaces are bought solely on a merit basis.

We are the pioneers in the making of Gas and Fuel oil furnaces, and our product combines the experience of **50 years** of furnace building with the best workmanship and material obtainable.

Our long list of users is the best evidence of the merit of G. & B. Furnaces. Want to look it over?

We build Gas and Fuel oil furnaces to meet your special requirements.

Put your problems up to us. Our advice will prove invaluable.

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Vol. XIV Publication Office: Toronto, December 23, 1915 No. 26

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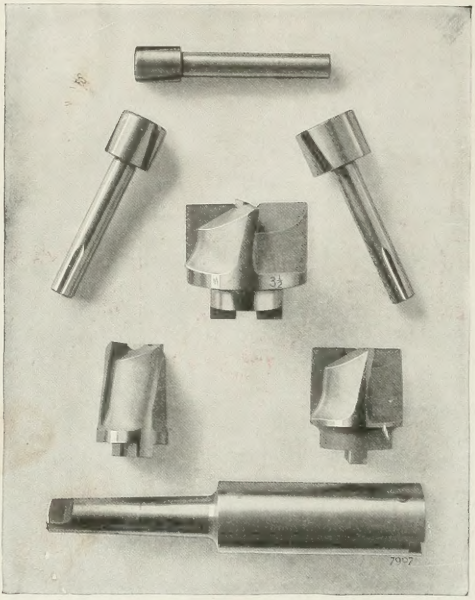
The Right Combination At Once

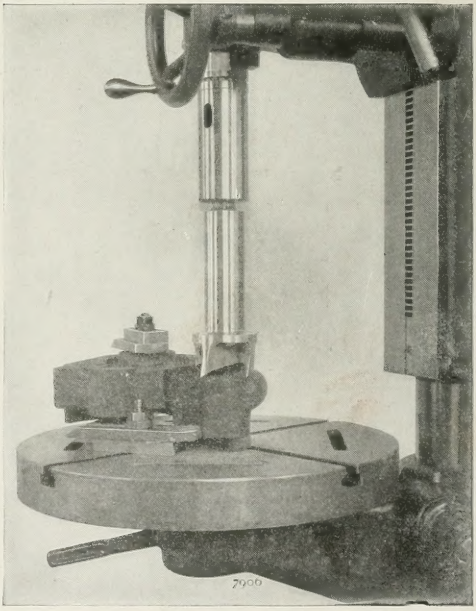


Holder, Cutter and Guide

For every counterboring job you can immediately make the right combination of holder, cutter and guide, if your tool room is equipped with

P. & W. Interchangeable Cutter Counterbores

Holders, Cutters and Guides furnished in wide range of sizes.



Spot Facing
with a P. & W. Interchangeable Cutter Counterbore.

Holders

End of holder is milled to receive the driving lug of the cutter and there is also a hole and set screw to accommodate the shank of the guides.

Guides

Are of hardened tool steel. They are held in place by means of a set screw in the holder engaging a V-slot in the shank of the guide.

Cutters

Can be furnished of either carbon or high speed steel.

The shank of the guide passes through the hole in the cutter and the shoulder between the guide and its shank keeps the cutter in place. Cutters can be sharpened on the face and the guide is simply pushed further in the hole after grinding.

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Place a trial order with our nearest store.

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